Up to Serial No. 11,536

TC-650

USA Model

ISO

Set using ISO screws

SPECIFICATIONS

Power Requirements: AC 117 V, 60 Hz, 90 W

Track System: Four-track stereo and mono
Two-track stereo and mono

Reel Size: 7" (18 cm) maximum

Tape Speed: 7½ ips and 3¾ ips
(19 cm/s and 9.5 cm/s)

Recording Time: (with 1,800 ft. tape)

Tape speed	4-track stereo	4-track mono
7½ ips (19 cm/s)	1.5 hrs	3 hrs
3¾ ips (9.5 cm/s)	3 hrs	6 hrs

Frequency Response: (with standard tape)
20 ~ 22,000 Hz at 7½ ips (19 cm/s)
20 ~ 18,000 Hz at 3¾ ips (9.5 cm/s)

Signal-to-Noise Ratio: (with standard tape)
54 dB (at peak level recording)

Flutter and Wow:
0.04% at 7½ ips (19 cm/s)
0.1 % at 3¾ ips (9.5 cm/s)

Recording Bias Frequency: Approx. 120 kHz

Inputs:
Four MIC inputs
Impedance: 600 Ω
Maximum sensitivity: 0.2 mV (-72 dB)
Two LINE INputs
Impedance: 100 kΩ
Maximum sensitivity: 70 mV (-22 dB)

Outputs:
Two LINE OUTputs
Impedance: 100 kΩ or more
Output level: 0.775 V (0 dB)
HEADPHONE output
Impedance: 8 Ω load
Output level: 0.038 V (-26 dB) with 8 Ω load
(When line output level is 0 dB)

Semiconductors: 44 transistors and 51 diodes

Dimensions: 16⅜ (W) x 9½ (H) x 17¼" (D)
(420 x 246 x 446 mm)

Weight: 46 lb (21 kg)

SONY®

SERVICE MANUAL

TABLE OF CONTENTS

SECTION 1
GENERAL DESCRIPTION

1-1. SYSTEMS CONTROL CIRCUITS

Systems control of the TC-650 is accomplished by transistor logic, relays, and solenoids. Systems control is divided into two major areas and their respective functions as follows:

Power Supply Circuits

A. Systems control
B. Record and playback amplifiers

Function Controls

A. Flip-flop circuit
B. Relay operations
C. Solenoid operations
D. Automatic shut-off
E. Stop delay
F. Muting

Table 1. Transistor Functions

Transistor	*Function*
Q701, 702, 802	Voltage regulation (Systems Control Circuit)
Q703, 704, 705	Voltage regulation (Amplifier Section)
Q706	Ripple filter (equalization selection)
Q707, 708	Flip-flop
Q709	Stop delay
Q710	Muting
Q711	Drives Play relay
Q712	Drives Speed Selector relay
Q801	Automatic shut-off
Q803, 804, 805	Solenoid operations

Power Supply Circuits

The TC-650 utilizes two full-wave diode bridges (D701 through D708) to supply B+ to the recorder (Fig. 1-1-1). Voltage regulation for systems control is accomplished by transistors Q701, Q702, and Q802. Transistor Q702 senses changes in the B+ voltage and applies correction signals to control transistor Q701. Q701 applies correction signals to regulator transistor Q802 to maintain B+ at +23 volts DC.

Voltage regulation at +22 volts DC for the amplifier circuits is accomplished in an identical manner by transistors Q703, Q704, and Q705. Diode D709 blocks DC current flow from the amplifier voltage regulator to the diode bridge. Additionally, ripple filter transistor Q706 applies approximately +20 volts DC to section 3 of speed selector relay RY704. When the relay is in the 7½ ips position, this voltage biases diode D304 on; in the 3¾ ips position, the voltage is removed from the circuit; thus accomplishing proper equalization at both speeds.

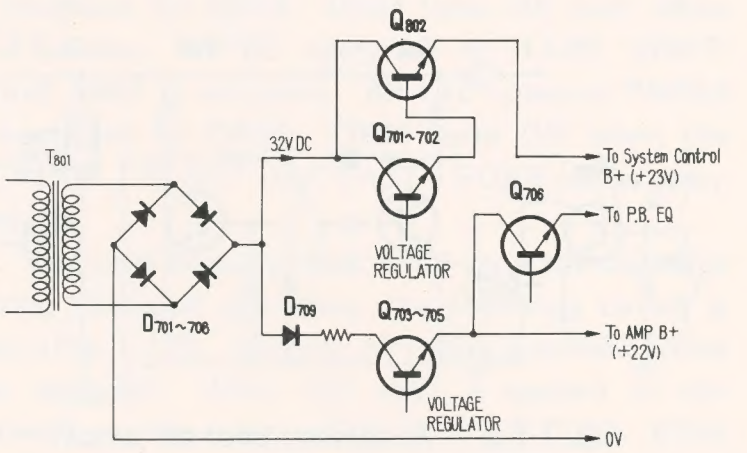


Fig. 1-1-1. Power supply circuits

Function Controls

Flip-Flop Circuit:

The flip-flop (Fig. 1-1-2) comprises Q707, Q708, R714 through R719, D716, D717, and C716. The normal condition of Q707 is OFF and Q708 is ON. When PLAY pushbutton S805 is depressed, the collector voltage of Q707 and base voltage of Q708 go to 0 volts. This turns Q708 OFF and Q707 ON. The resulting positive voltage developed across R715, R717, and D717 holds Q707 ON. The flip-flop remains in this condition until the automatic shut-off, STOP, FAST FORWARD, or REWIND switches are activated. These switches remove the ground from the emitters of Q707 and Q708, causing the flip-flop to reset.

The collector output of Q707 turns Q711 ON, which energizes PLAY relay RY702. The output also holds bias oscillator relay RY501 energized if RECORD MODE switch S605 or S606 and RECORD switch S802 have been activated.

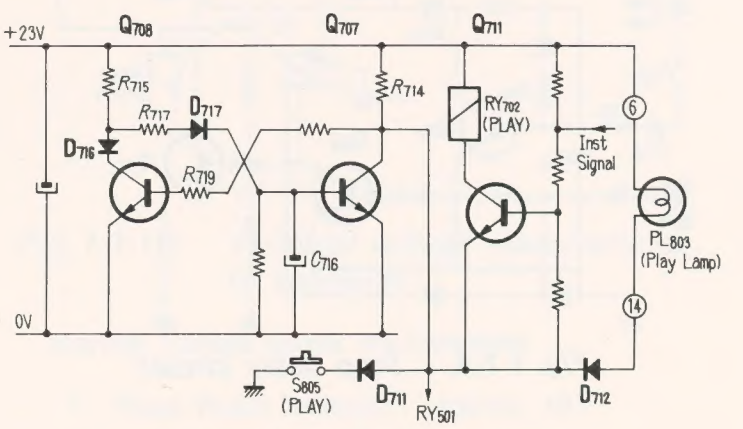


Fig. 1-1-2. Flip-flop circuit

Automatic Shut-off:

Tape sensing (automatic shut-off) switch S808 opens up when tape is properly threaded in the TC-650. This permits Q801 to turn ON. The resulting 0 volts at the collector of Q801 provides the ground for the flip-flop and relay circuits. Tape breakage or run out closes the switch and turns Q801 OFF. This resets all circuits and stops the TC-650.

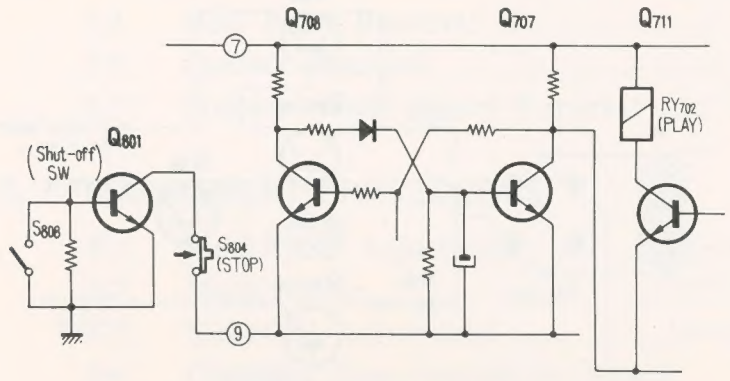


Fig. 1-1-3. Automatic shut-off circuit

Stop Delay:

When changing from FAST FORWARD or REWIND to PLAY, or when changing speeds, a two second pause is generated by the stop delay circuit (Fig. 1-1-4).

When in FAST FORWARD or REWIND, +23 volts is applied to the base of Q710 and C709. Q710 and Q709 are turned ON and C709 charges. When PLAY pushbutton S805 is depressed, the FAST FORWARD or REWIND relay is de-energized; but C709 discharges, holding Q710 and Q709 ON for approximately two seconds.

When in PLAY and changing to a lower (or higher) speed, using S607, the potential charged at C605 (C606) discharges through D713 and R725, and turns Q710 and Q709 on for approximately two seconds. This turns Q711 OFF and causes the machine to pause until Q710 and Q709 turn OFF and turn Q711 ON again.

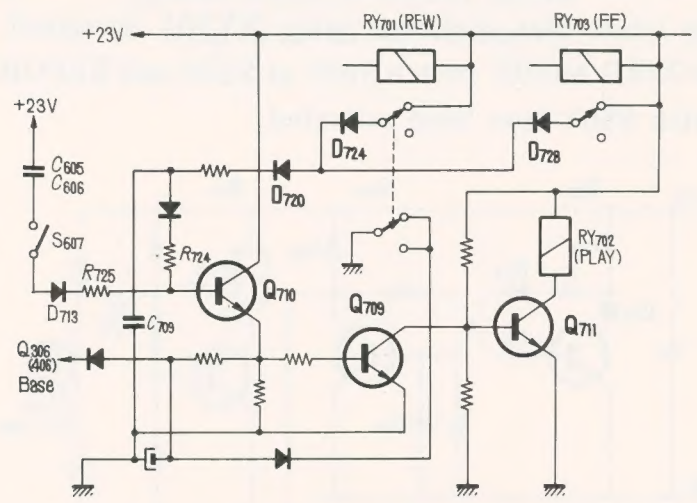


Fig. 1-1-4. Stop delay circuit

Muting:

The playback amplifier is muted when changing speeds, or from FAST FORWARD (or REWIND) to PLAY (Fig. 1-1-5). The sequences of events are the same as in the stop delay circuit.

The muting output is the positive potential at the emitter of Q710 when it is ON. This turns Q306 (Q406) ON and grounds the playback output. However, when in the FAST FORWARD or REWIND mode, the ground from RY701 pole 3 or RY703 pole 4 brings the potential to ground; thus defeating the muting signal. Therefore, the playback signal can be heard by actuating TAPE SHIFT switch S807.

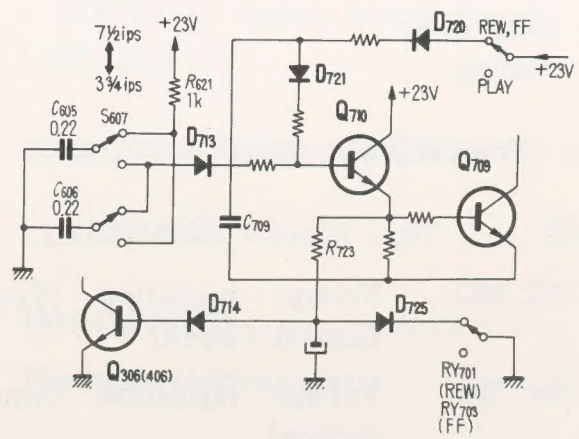


Fig. 1-1-5. Muting circuit

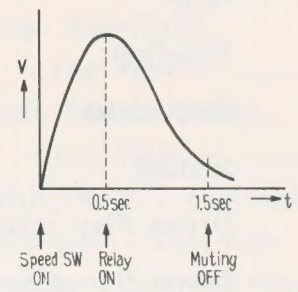


Fig. 1-1-6. Muting characteristics curve

Relay Operations:

REWIND relay RY701 is energized by depressing REWIND pushbutton S803. RY701 is held in the energized position by the ground connection across pole 4 of the relay contacts.

The resulting voltage drop across pole 2 through diodes D724 and D727 causes Q805 to turn ON. Brake solenoid PM803 actuates and releases the brake mechanism. Additionally, 100 volts AC is applied directly to the windings of supply reel motor M802 across pole 1 of RY701 and to M803 through R801. RY701 is de-energized by removing system power or depressing the STOP, PLAY, or FAST FORWARD pushbuttons.

PLAY relay RY702 is energized by depressing PLAY pushbutton S805. RY702 is held in the energized position by 0 volts from the collector of Q711. Q711 is turned ON and held ON by 0 volts from the collector of flip-flop transistor Q707.

55 volts AC is applied across pole 1 of RY702 through torque adjust resistors R802 and R803 to supply and take-up reel motors M802 and M803. 24.5 volts AC is applied across pole 3 of RY702 to the base of Q803; which causes PINCH ROLLER solenoid PM801 to actuate. 24.5 volts AC is applied across pole 4 of RY702 to the base of Q805; which causes BRAKE solenoid PM803 to actuate. A ground connection for Q804 is supplied across pole 2. Q804 turns ON and TAPE SHIFTER solenoid PM802 energizes.

FAST FORWARD relay RY703 is energized by depressing FAST FORWARD pushbutton S806. RY703 is held in the energized position by the ground connection across pole 2 of the relay contacts.

The resulting voltage drop across pole 3 through diodes D727 and D728 causes Q805 to turn ON. Brake solenoid PM803 actuates and releases the brake mechanism. 100 volts AC is applied across pole 1 of the relay contacts directly to take-up reel motor M803 and to M802 through R801.

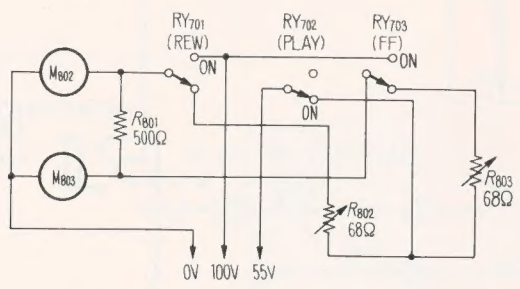


Fig. 1-1-7. Motor circuit

SPEED SELECTOR relay RY704 is energized by placing switch S607 in the 3¾ ips position. This applies +23 volts DC to resistor R741. The time constant of C714 and R741 determines the delay time before Q712 turns ON and energizes RY704. This delay eliminates relay popping.

Pole 4 provides a connection to R743; which provides the proper time constant for turning off Q712 when changing speed back to 7½ ips.

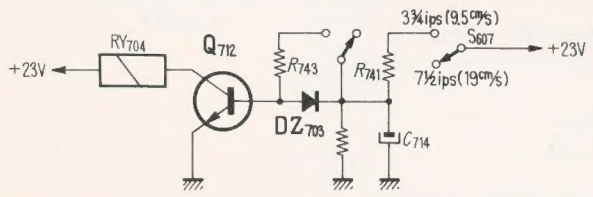


Fig. 1-1-8. Tape speed selector circuit

Opening the contacts of pole 3 removes the bias across D304 and provides the correct equalization for 3¾ ips. Poles 1 and 2 remove 100 volts AC from the four pole winding of capstan motor M801 and apply it to the eight pole windings of M801.

Solenoid Operations:

PINCH ROLLER solenoid PM801 is energized by Q803. Q803 turns ON only when PLAY relay RY702 energizes. TAPE SHIFTER solenoid PM802 is energized by Q804. Q804 turns ON only when PLAY relay RY702 energizes or TAPE SHIFT switch S807 is actuated. BRAKE solenoid PM803 is energized by Q805. Q805 turns ON when the REWIND, PLAY, or FAST FORWARD relay energize.

To avoid excessive heat build-up in the solenoids during extended operation, the following circuit is used (Fig. 1-1-9). Initially, +23 volts is applied across the solenoid. Also, +23 volts is applied to the network comprising R735 (R732, R729), R736 (R733, R730), and C713 (C712, C711). A high potential is instantaneously applied to the base of Q803 (Q804, Q805). As the internal impedance of C713 (C712, C711) approaches that of R736 (R733, R730) the voltage at the base decreases. The voltage across the solenoid also decreases as shown in Fig. 1-1-10.

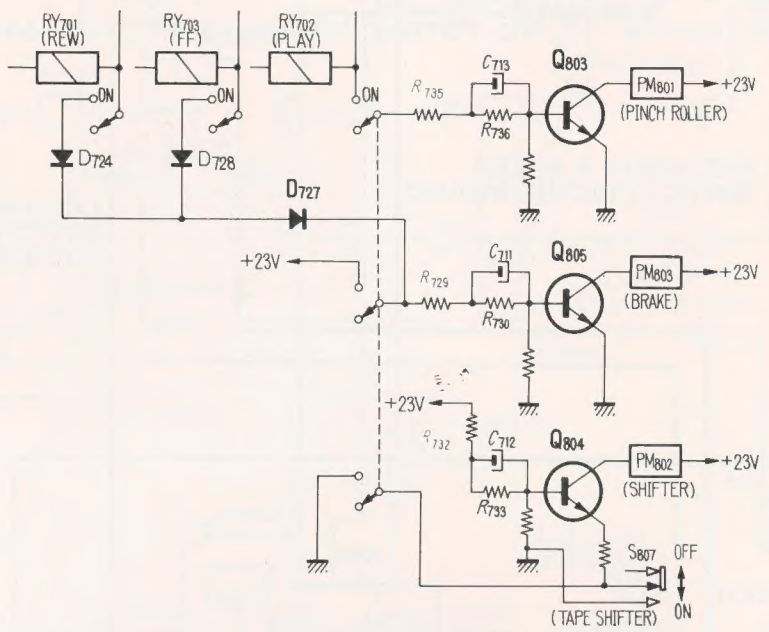


Fig. 1-1-9. Solenoid driving circuit

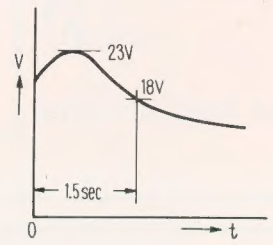


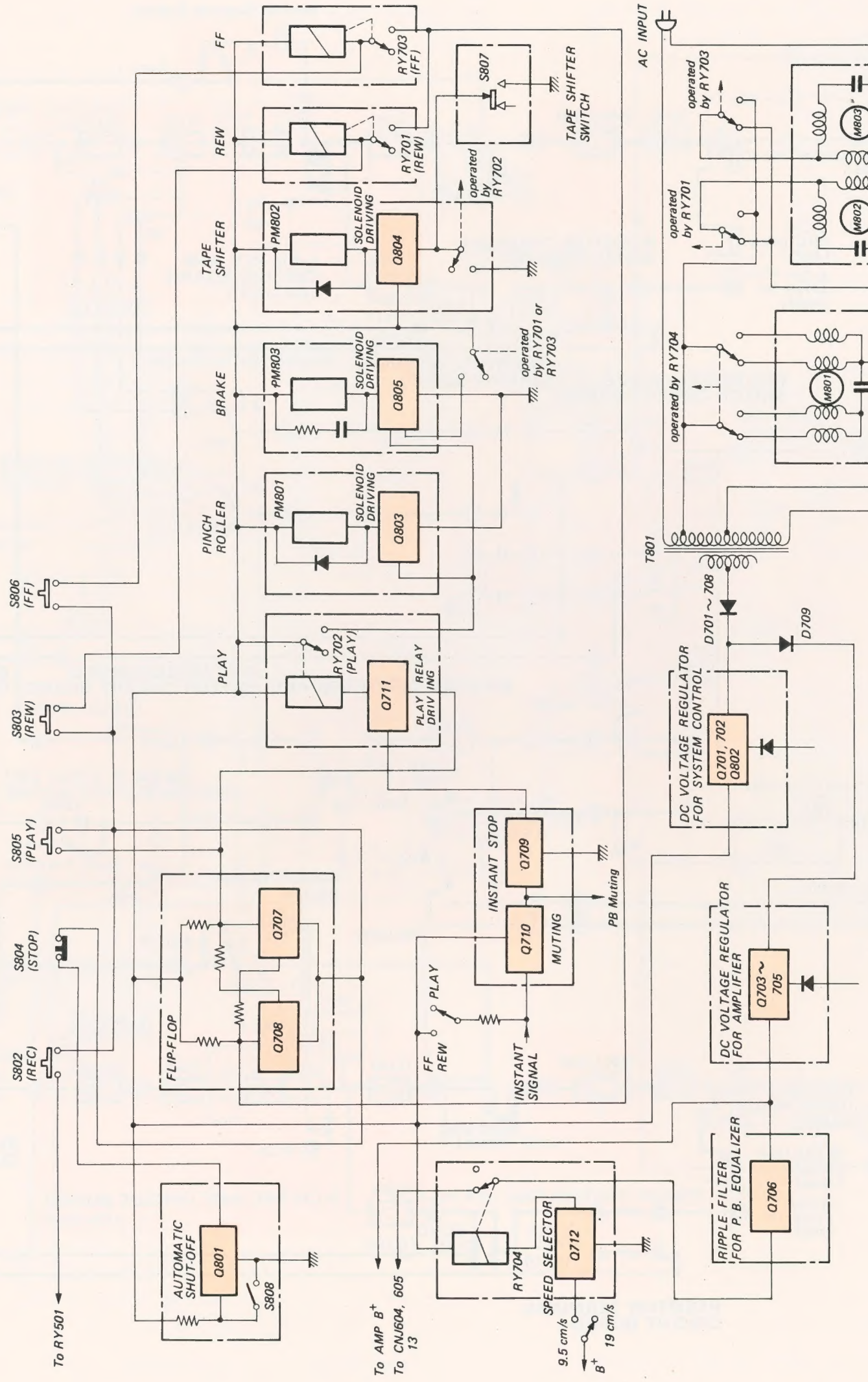
Fig. 1-1-10. Terminal voltage characteristics of solenoids.

Normal Voltage across the Solenoids

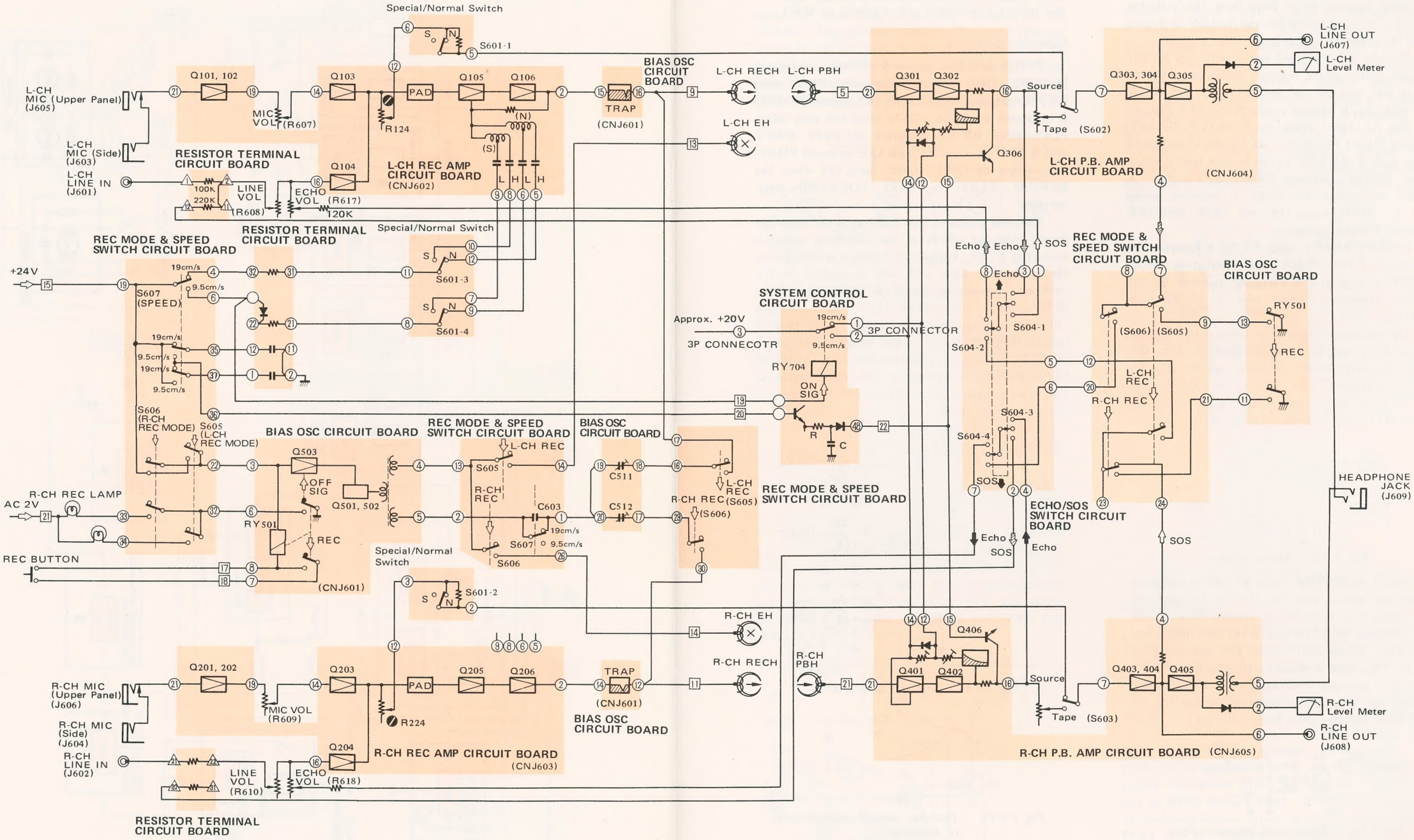
1 Pinch Roller Solenoid : approx. 18V
2 Brake Solenoid : approx. 14V
3 Tape Shifter Solenoid : approx. 15V

1-2. BLOCK DIAGRAM

1-2-1. System Control Circuit

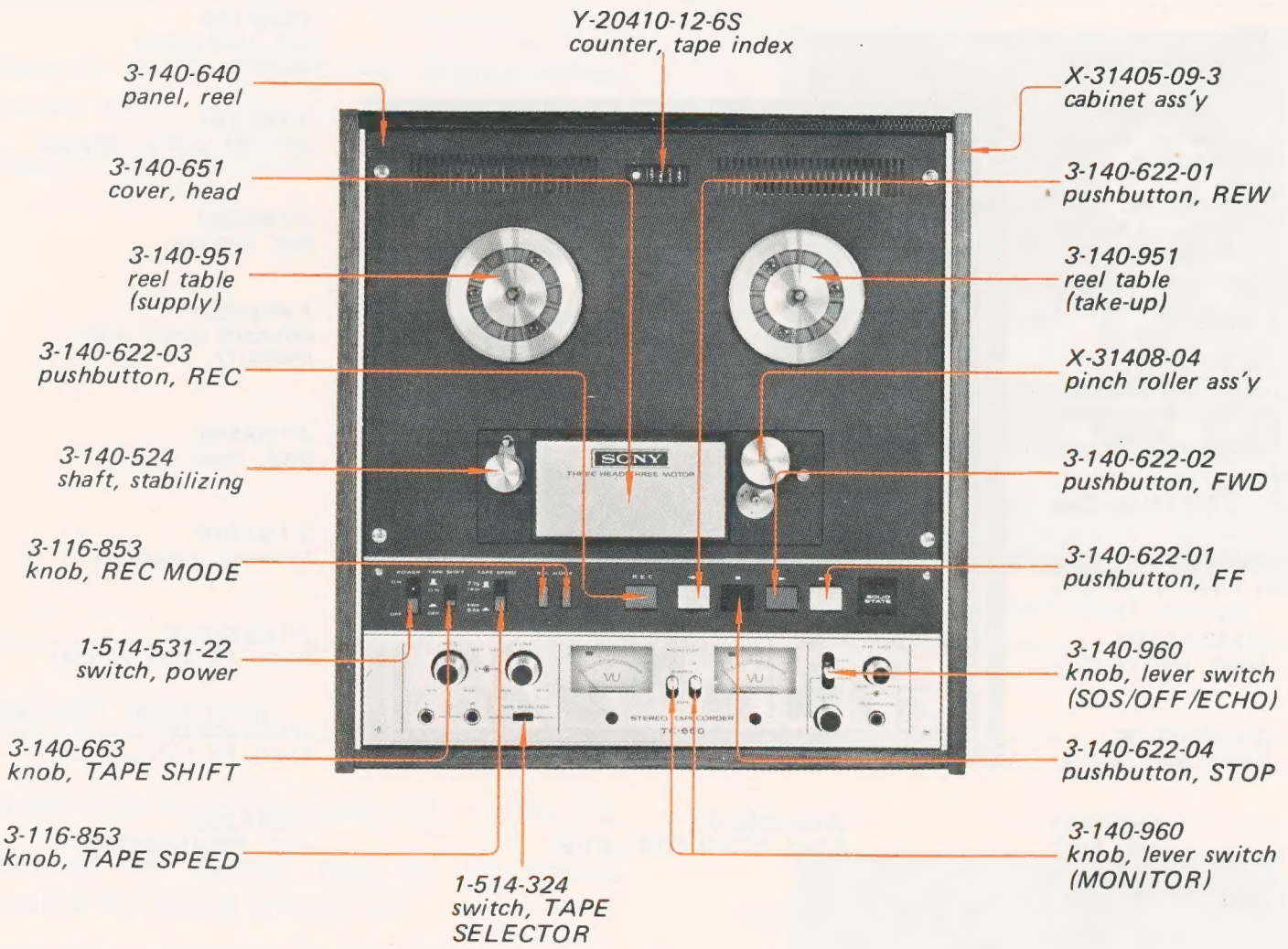


1-2-2. Amplifier Circuit

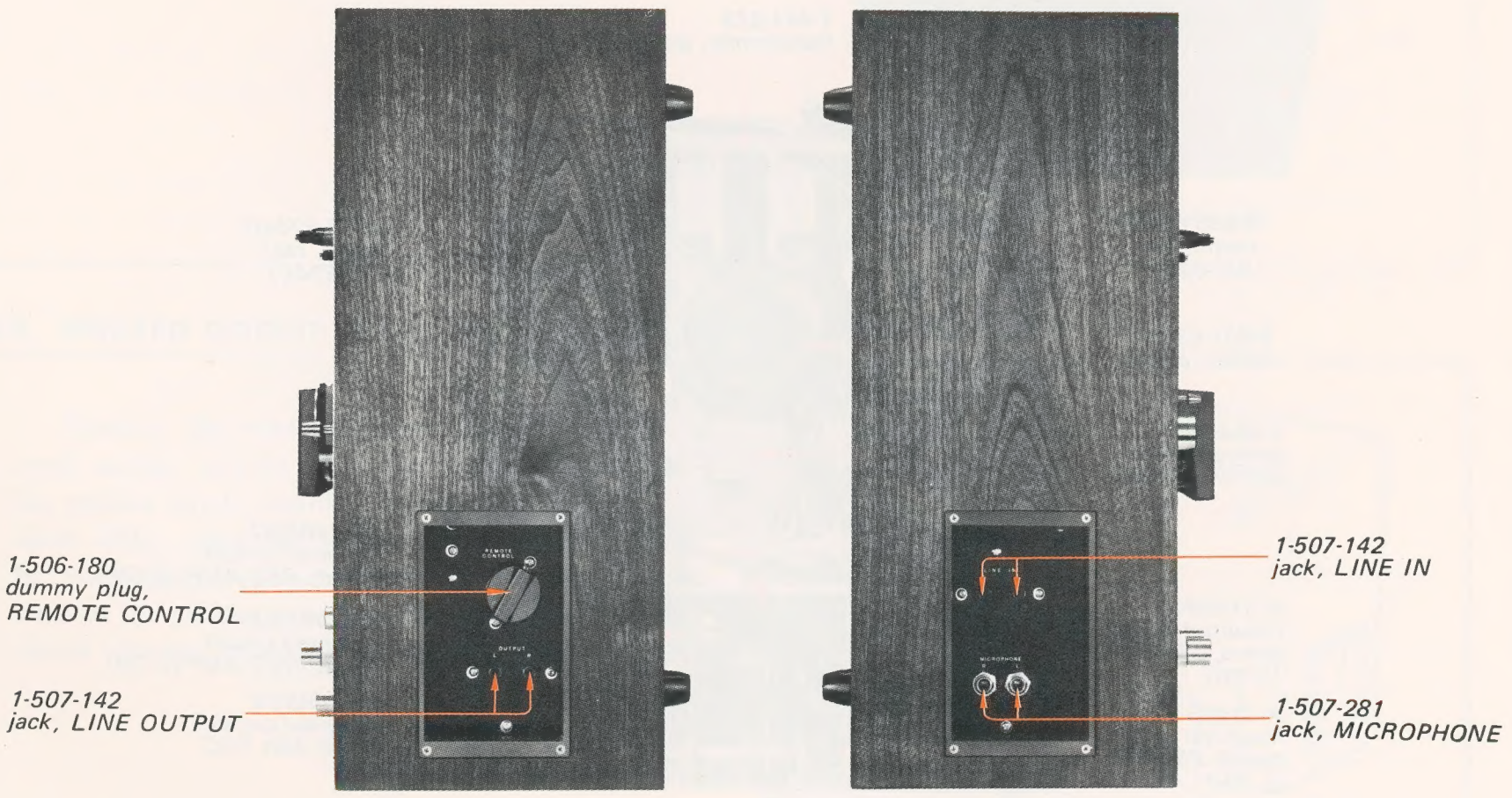


1-3. MAJOR PARTS LOCATIONS

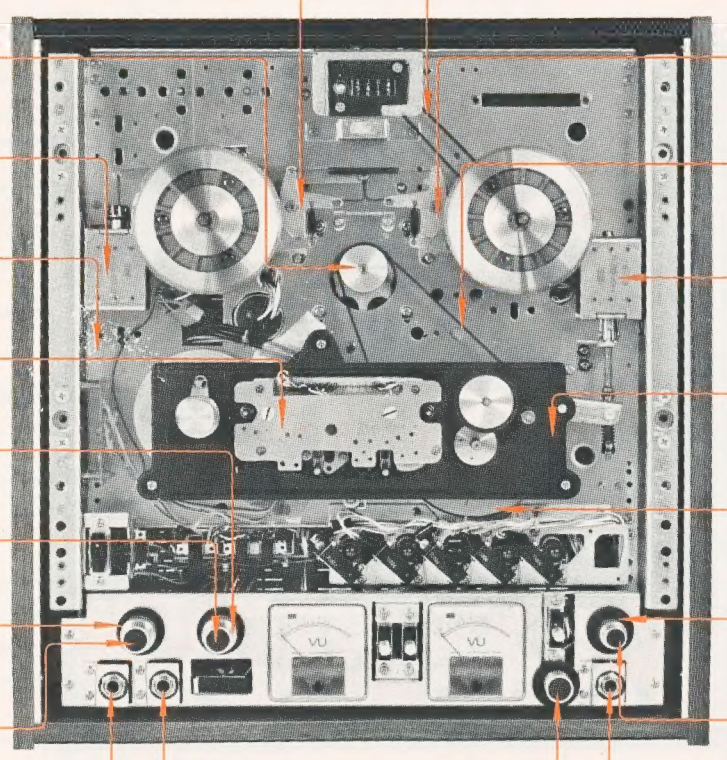
Cabinet — Top View —



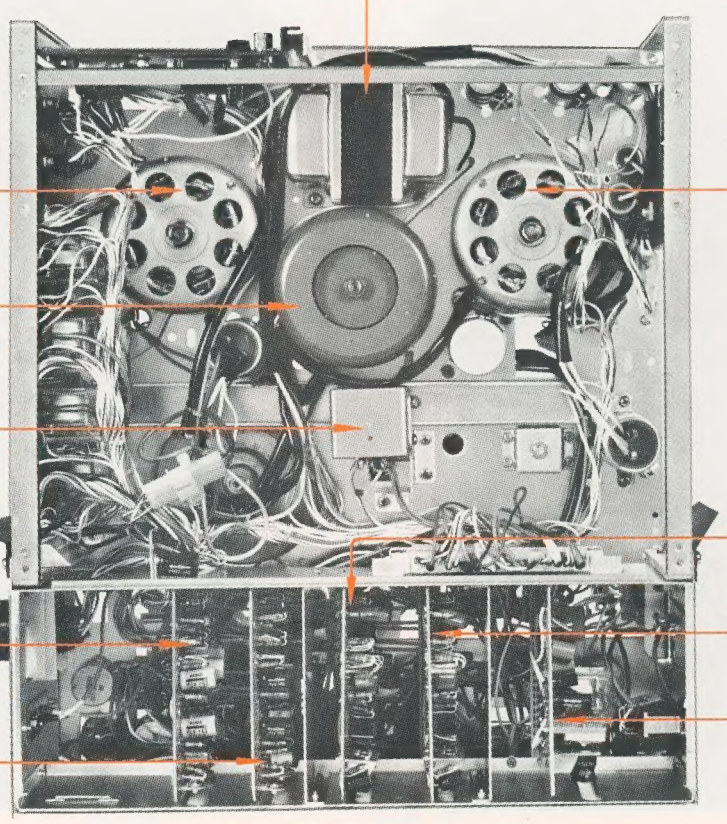
Cabinet — Side Views —



Chassis — Top View —



Chassis — Bottom View —



SECTION 2
DISASSEMBLY

2-1. REEL PANEL REMOVAL

(1) Remove the four reel panel holding screws shown with ▲ in Fig. 2-1.

(2) Remove the reel panel.

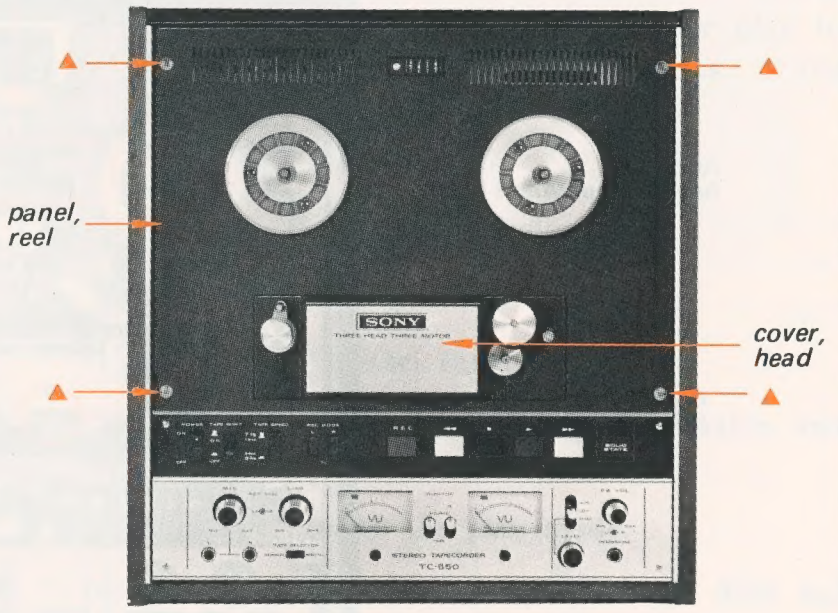


Fig. 2-1. Reel panel removal

2-2. CABINET REMOVAL

(1) Remove the six screws shown with ● in Fig. 2-2.

(2) Remove the dummy plug for the remote control by pulling straight up.

(3) Remove the chassis from the cabinet.

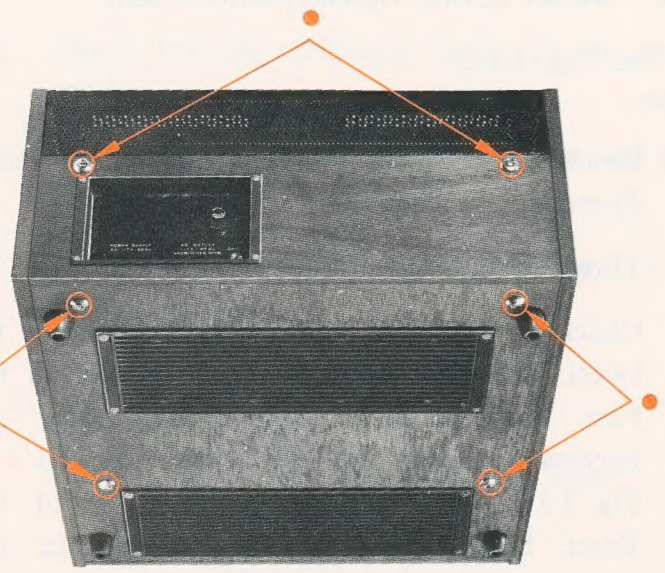


Fig. 2-2. Cabinet removal

2-3. PRINTED CIRCUIT BOARD REMOVAL

Remove the ventilator by taking off the four wood screws (⊕K 4x16). See Fig. 2-3. Pull off the printed circuit boards, PB AMP, REC AMP and BIAS OSC. Here the voltage check can be made by removing the cabinet or by using the special jig without the cabinet removed. Remove other printed circuit boards, referring to the cabinet removal.

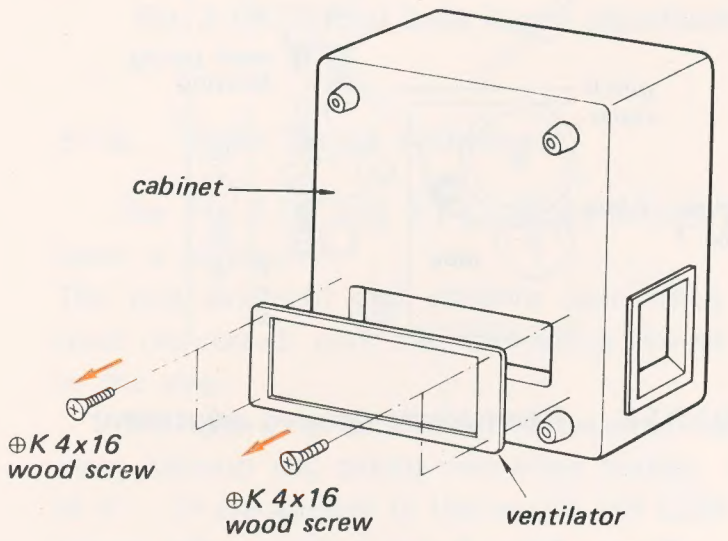


Fig. 2-3. Printed circuit board removal

SECTION 3
ADJUSTMENT PROCEDURES

3-1. MECHANICAL ADJUSTMENT

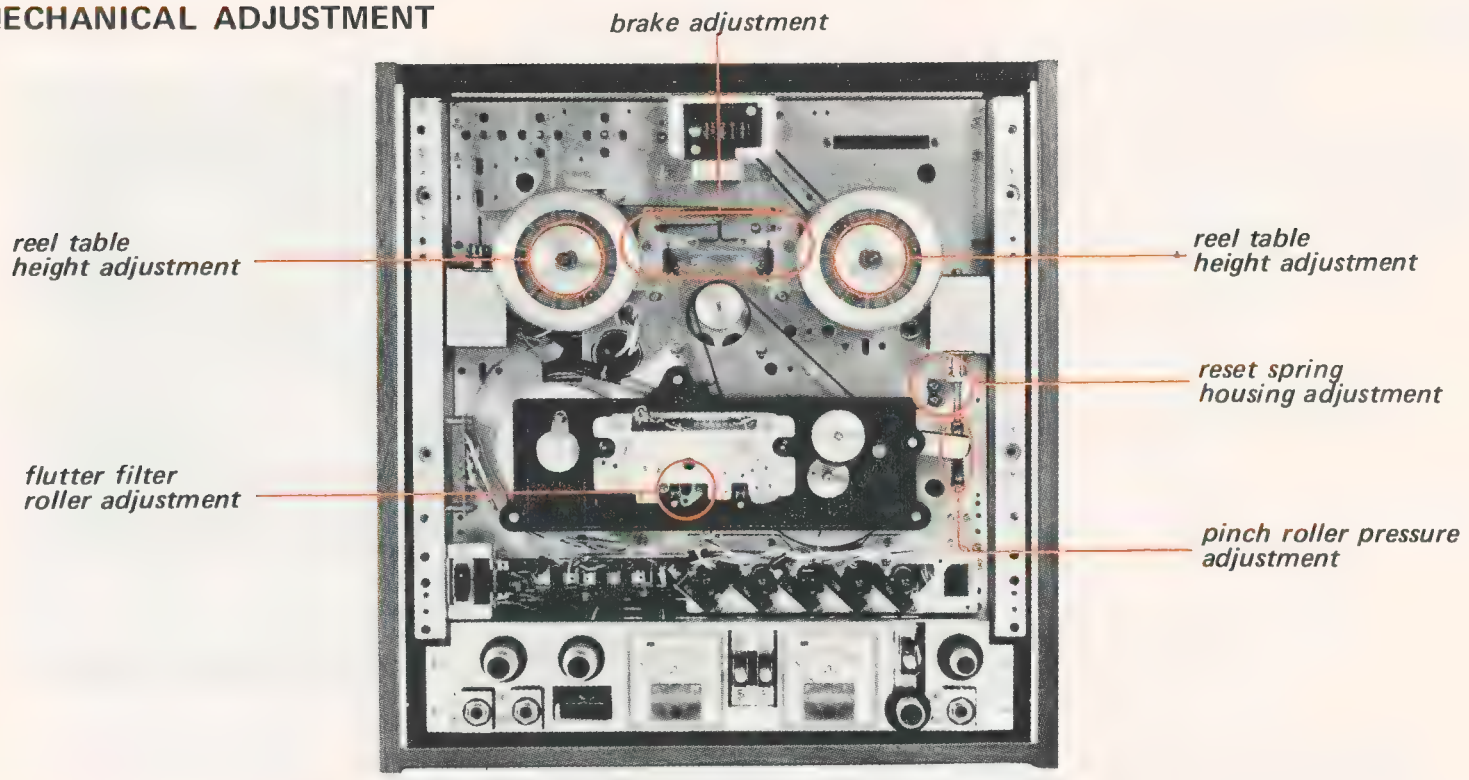


Fig. 3-1-1. Adjusting parts location

3-1-1. Reset Spring Housing Adjustment

See Fig. 3-1-2.

Steps:

(1) Remove the Reel Panel. See "Reel Panel Removal" in page 11.

(2) Thread a tape.

(3) Check for approx. 1 mm (3/64") clearance between the tape and the Pinch Roller in the Fast Forward and the Rewind mode. If necessary, loosen the two screws marked ▲ in Fig. 3-1-2, and adjust the position of the Reset Spring Housing by moving in the directions shown by the arrows.

(4) After the adjustment, apply lock paint to the adjusting screws.

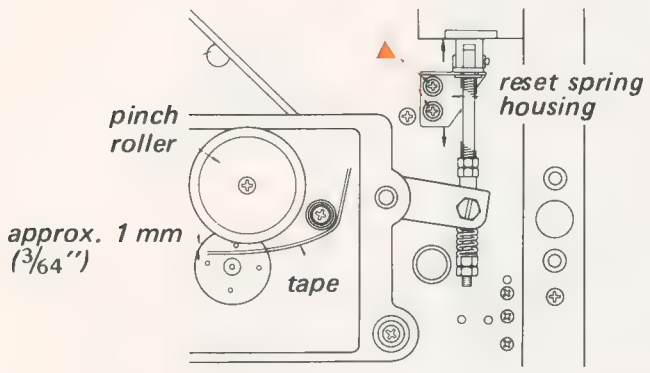


Fig. 3-1-2. Reset spring housing adjustment

3-1-2. Flutter Filter Roller Adjustment

See Fig. 3-1-3.

Steps:

(1) Remove the Head Cover.

(2) Thread a tape and set the unit to the play mode.

(3) Adjust the height of the Flutter Filter Roller by the screws marked ▲ and ● in Fig. 3-1-3 so that the tape runs through the middle of the Flutter Filter Roller.

(4) Turn the screw marked ● in Fig. 3-1-3 to perform the azimuth adjustment of the Flutter Filter Roller.

(5) For zenith adjustment turn the two screws marked ▲ in Fig. 3-1-3 to contact the tape uniformly with the record and playback heads.

(6) Make sure that the Flutter Filter Roller smoothly rotates during tape running. Apply lock paint to the adjusting screws.

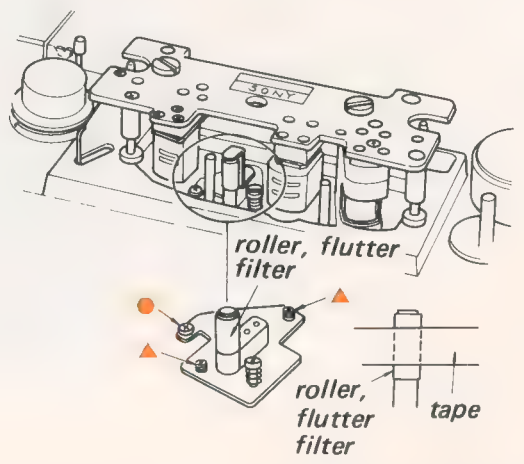


Fig. 3-1-3. Flutter filter roller adjustment

3-1-3. Pinch Roller Pressure Adjustment

See Fig. 3-1-4 and 3-1-5. This adjustment should be made after the Reset Spring Housing Adjustment.

Steps:

(1) Remove the Reel Panel.

(2) Set the unit to the paly mode.

(3) Adjust the adjusting nut (A) for 1 mm (3/64") clearance between the Link Shaft and the adjusting nut (A). See Fig. 3-1-4.

(4) Make a loop with a piece of string and attach the spring scale to the Pinch Roller Shaft with the loop of string. See Fig. 3-1-5. Pull the scale horizontally in the direction shown by the arrow. The Capstan Shaft, Pinch Roller and the spring scale should be in a line. Check the reading when the Pinch Roller just leaves the Capstan Shaft.

(5) Adjust the adjusting nut (B) for 2.5±0.2 kg (5 to 6 lb).

(6) Repeat steps 3 to 5 several times.

(7) After adjustment lock the adjusting nut (B) by the lock nut (B), and the adjusting nut (A) by the lock nut (A). (Be careful not to move the adjusting nuts.)

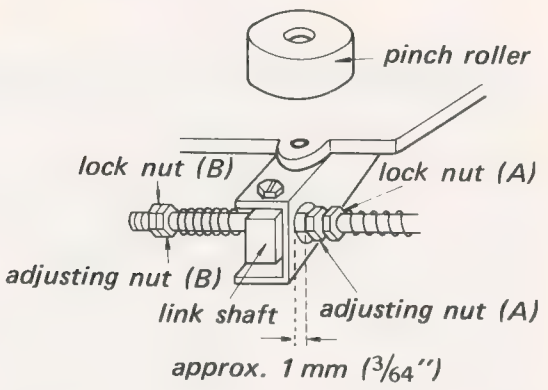


Fig. 3-1-4. Pinch roller pressure adjustment (1)

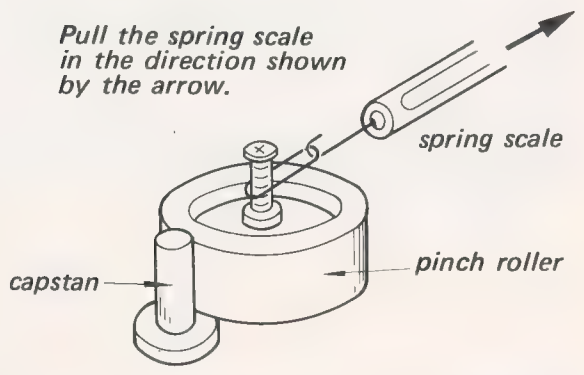


Fig. 3-1-5. Pinch roller pressure adjustment (2)

(8) Make sure that the unit operates normally when a mode is changed from the play to the stop and vice versa several times. If the tape slips, readjust the above steps.

3-1-4. Reel Table Height Adjustment

Steps:

(1) Remove the Reel Panel.

(2) Place a 7-inch reel onto the Reel Table, and thread a tape.

(3) Set the unit to the play mode.

(4) Check both reels to see that tape does not touch either flange of the reels. If the tape is not taken up on the mid portion between the upper and the lower flanges of the reel, loosen the set screws with an allen wrench (hexagon socket), and adjust the reel table height.

(5) Check for the reel table height in the rewind mode.

(6) Exchange the reels. Check for the reel table height.

(7) After the adjustment, apply lock paint to the adjusting screws.

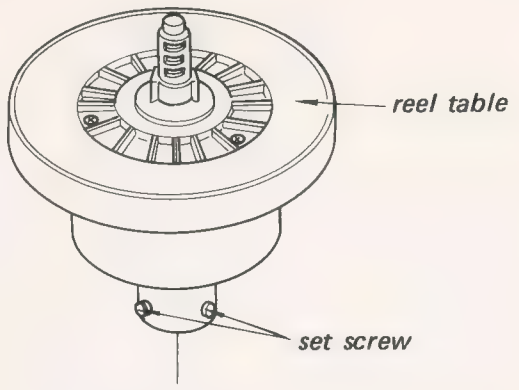


Fig. 3-1-6. Reel table height adjustment

3-1-5. Brake Torque Adjustment

See Fig. 3-1-7 and 3-1-8. Brake torque adjustment is required if:
The reel pays out and slackens tape when going from the record, play, fast forward or rewind mode to the stop.

The following adjustment is required for both sides, take-up and supply reel table brakes. Words in < > are applied to the supply reel table brake torque adjustment.

Setup

(1) Remove the Reel Panel, referring to the "Reel Panel Removal" in page 11.

(2) Take off the two screws shown by the mark ■ in Fig. 3-1-7, and remove the Reel Table.

Counterclockwise < Clockwise > Brake Torque Adjustment

Steps:

(1) Set the unit to the stop mode.

(2) Loosen the two screws shown by the mark ▲ in Fig. 3-1-7.

(3) Adjust by positioning the Brake Arm horizontally so that the one-fourth part of the Brake Lining from the end of bent portion contacts with the Brake Drum (See Fig. 3-1-7).

(4) Fix the two screws shown by the mark ▲ in Fig. 3-1-7, tentatively.

(5) Place an empty reel with string wound several turns counterclockwise < clockwise > on the hub (44 mm dia) onto the reel table. Tie the string to the spring scale. Pull the spring scale horizontally and at a constant speed. Check the reading for brake torque. It should be 300 g-cm to 500 g-cm (4.2 oz-inch to 7.0 oz-inch). Adjust the position of the Brake Arm by loosening the two screws shown by the mark ▲ in Fig. 3-1-7, if necessary, to obtain the specified brake torque and then fix the two screws.

(6) Set the unit to the play mode. Check that the clearance between the Brake Lining and the Brake Drum is 0.5 mm (1/64"). To obtain the specified clearance, loosen the two screws shown by the mark ● in Fig. 3-1-8, and adjust the brake arm (A) by moving in the directions shown by the arrows in Fig. 3-1-8.

(7) If necessary, bend the Link Rod (B) in the directions shown by the arrows in Fig. 3-1-7.

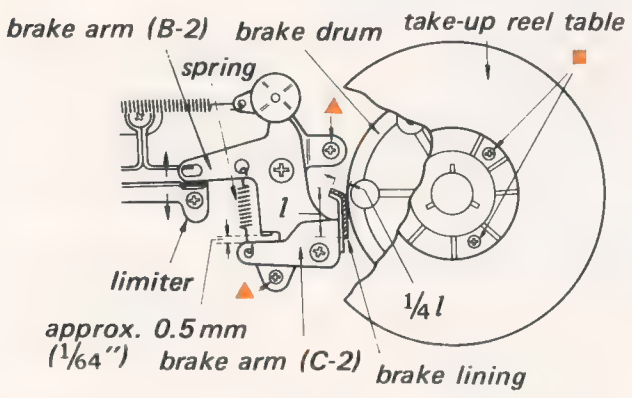


Fig. 3-1-7. Brake torque adjustment (1)

Clockwise < Counterclockwise > Brake Torque Adjustment

Steps:

(1) Set the unit to the stop mode.

(2) Place an empty reel with string wound several turns clockwise < counterclockwise > on the hub (44 mm dia) onto the reel table. Tie the string to the spring scale. Pull the spring scale horizontally and at a constant speed. Check the reading for brake torque. It should be 1,000 g-cm to 1,400 g-cm (14 oz-inch to 19 oz-inch). Bend the Limiter in the direction shown by the arrows in Fig. 3-1-7 to obtain the specified brake torque.

(3) Make sure that the Brake Arm (B-2) contacts with the Limiter and that the clearance between the convex part of the Brake Arm B-2 < B > and the Brake Arm C-2 < C > is 0.5 mm (1/64") or more as shown in Fig. 3-1-7 & Fig. 3-1-8.

(4) If the clearance is less than 0.5 mm (1/64"), expand the spring shown in Fig. 3-1-7 & Fig. 3-1-8.

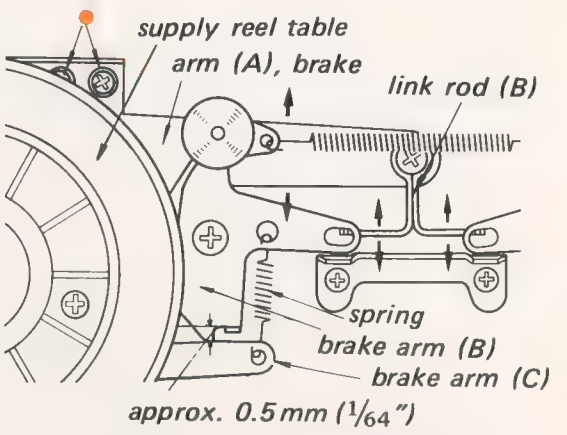


Fig. 3-1-8. Brake torque adjustment (2)

3-1-6. Reel Motor Torque Adjustment

Set the tape speed to 7 1/2 ips (19 cm/s).

1. Take-Up Motor Torque Adjustment

Steps:

(1) Place the reel with string wound several turns clockwise on the hub (44 mm dia) onto the Take-up Reel Table. Tie the string to the spring scale.

(2) Set the unit to the play mode. Pull the spring scale and then allow to take up the string on the reel while approaching the scale to the reel at the same speed of tape running. Adjust R803 by sliding the band for 260 to 280 g-cm (3.6 to 3.9 oz-inch) on the spring scale. See Fig. 3-1-9.

Note: Read the scale while moving it.

2. Back Tension Torque Adjustment

Steps:

(1) Place the empty hub with string wound several turns counterclockwise on the hub (44 mm dia) onto the Supply Reel Table. Tie the string to the spring scale.

(2) Set the unit to the play mode. Pull the spring scale at the same speed of tape running. Adjust R802 by sliding the band for 240 to 280 g-cm (3.3 to 3.9 oz-inch) on the spring scale. See Fig. 3-1-9.

Note: Read the scale while pulling it.

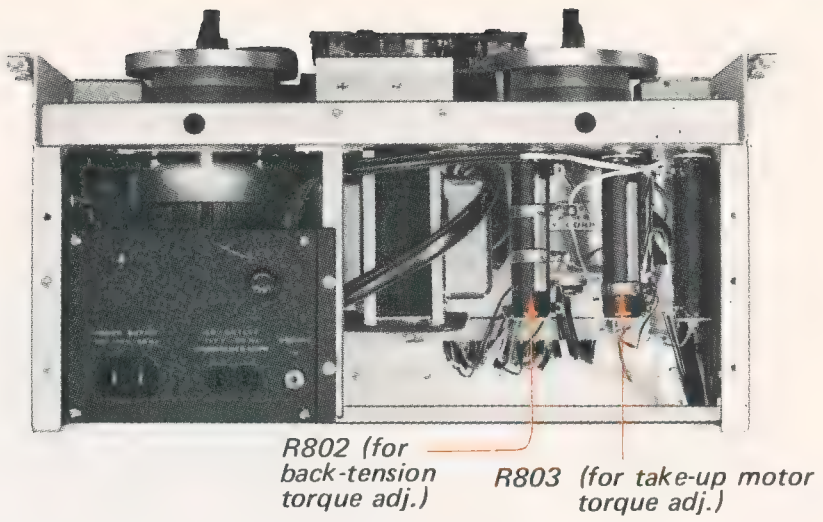


Fig. 3-1-9. Adjusting parts location for reel motor torque adjustment

3-2. MAINTENANCE

3-2-1. Lubrication

Use light machine oil and lubricate the pinch roller shaft and capstan drive motor lubricating hole. Avoid excessive lubrication. It will cause slippage of the mechanism. If the oil should spill on the pinch roller or the rubber belt, wipe it off immediately with denatured alcohol. To lubricate them, proceed as follows:

(1) Remove the head cover and the screw securing pinch roller and then lubricate the pinch roller shaft with one drop of light machine oil.

(2) Remove the reel panel and lubricate the motor lubricating hole with several drops of light machine oil.

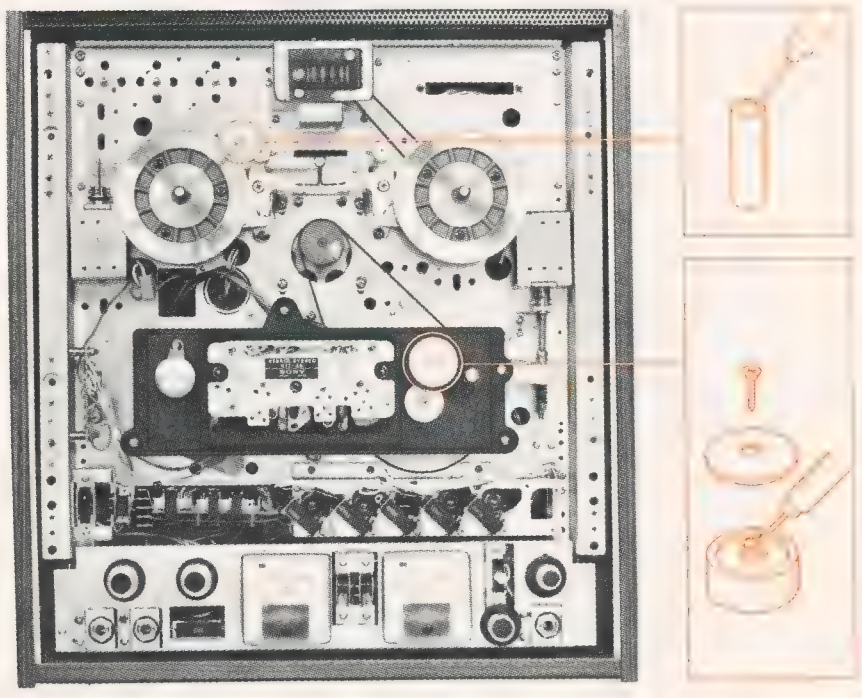


Fig. 3-2-1. Lubrication

3-2-2. Cleaning

Dusts and dirts which were brought by tape may stick to the core of the record, playback or erase head, and they may deteriorate performance of the playback head. So wipe off the surface of head which contacts tape, with a clean and soft cloth dampened with denatured alcohol. To insure proper operation, the heads should be cleaned at least once during each ten hours of actual operation.

CAUTION

Do not use any other solvent on the head as some will damage the material which binds the head laminations together. Also do not use any metallic device which will scratch the head.

At the same time, clean capstan, rubber belt, pinch roller, tape guide, flutter filter roller and stabilizing shaft.

3-2-3. Demagnetizing

The record and playback heads may occasionally aquire a degree of permanent magnetization, which will result in an increase of noise level, distortion of any recorded signal, and a gradual erasure of high frequency on any recorded tape which passed over them. These heads may be easily demagnetized with a SONY head demagnetizer HE-2 (optional accessory) or equivalent.

To demagnetize the heads, proceed as follows:

Steps:

(1) Remove the head cover.

(2) Make sure that power switch on the TC-650 is in the OFF position.

(3) Connect the demagnetizer to ac power source.

(4) Bring the tips of the demagnetizer in close proximity to, but not in contact with, the heads so that the tips straddle the gap in the center of the head, run the tips up and down the heads several times, and then slowly withdraw the demagnetizer.

CAUTION

Do not bring magnet close to heads.

3-3. ELECTRICAL ADJUSTMENT

Precaution:

Before making the adjustment, read the following carefully.

(1) Set the PB VOL control to the position where the VTVM indicates 0 dB (0.775 V) when playing back the first tone (400 Hz, 0 dB) of SONY alignment tape J-19-F2, except the dummy coil and the bias trap coil adjustments.

(2) Set the switches to the position indicated below, unless otherwise specified.

TAPE SPEED switch ..... 19 cm/s (7½ ips)
SOS & ECHO switch ..... OFF
MONITOR switch ..... TAPE
TAPE SELECTOR switch ..... NORMAL

(3) Clean the heads with soft cloth dampened with denatured alcohol and also demagnetize them with a demagnetizer.

(4) A new tape or a sufficiently-demagnetized tape should be used as a blank test tape.

(5) The test equipments needed for the adjustment are as follows:

Audio oscillator
Attenuator
600 Ω and 100 kΩ resistors
VTVM
Non-magnetic screwdriver
SONY alignment tapes, J-19-F2 and J-9-F1
Blank tape
SONY SLH blank tape

(6) Connect the VTVM and the 100 kΩ resistor in parallel with LINE OUT jack, except the dummy coil adjustment.

(7) SONY alignment tapes contain the following information in the sequence indicated.

tape \ tone	1st	2nd	3rd	4th	5th	6th	7th
J-19-F2	400 Hz 0 dB	400 Hz -10 dB	10 kHz -10 dB	12.5 kHz -10 dB	7 kHz -10 dB	80 Hz -10 dB	40 Hz -10 dB
J-9-F1	5 kHz -10 dB	400 Hz 0 dB	400 Hz -10 dB	5 kHz -10 dB	3 kHz -10 dB	200 Hz -10 dB	80 Hz -10 dB

(8) Reference No. in the parentheses are applied to R-CH adjustment.

3-3-1. Head Adjustment

Avoid making any adjustment other than azimuth adjustment, as special equipments are required for any other head-adjustment.

Playback Head Azimuth Adjustment

Steps:

(1) Thread the SONY alignment tape (J-19-F2) onto the unit.

(2) Set the tape speed to 7½ ips (19 cm/s).

(3) Make the connections as shown in Fig. 3-3-1.

(4) Loosen the azimuth adjusting screws of A block (or B block) equally.

(5) Play back the third tone (10 kHz) of the alignment tape. Adjust the azimuth adjusting screws (⊖SC 2×3) of B block (or A block) for maximum reading on the VTVM at both channels by tightening or loosening equally. Tighten the screws of A block (or B block) after the correct azimuth angle has been obtained.

(6) Apply lock paint to the screws.

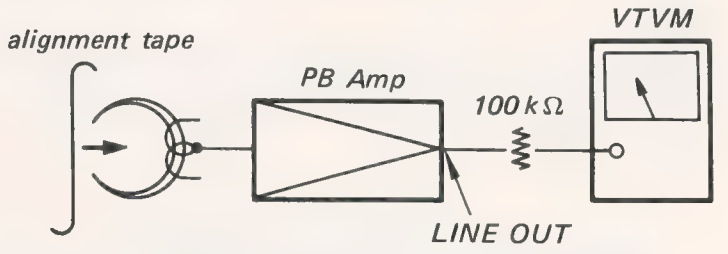


Fig. 3-3-1. Head adjustment setup

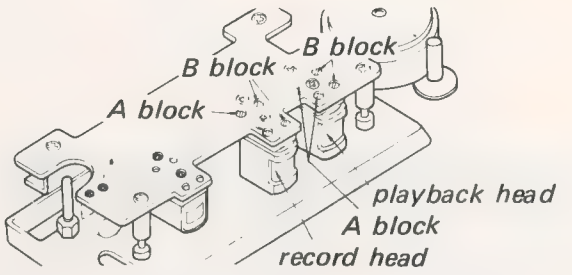


Fig. 3-3-2. Adjusting parts location

Record Head Azimuth Adjustment

Perform this adjustment after that for the playback head was done.

Steps:

(1) Thread a blank tape.

(2) Deliver a 15 kHz signal of −20 dB (77.5 mV) from the audio oscillator to the LINE IN jack, and then set the unit to the record mode.

(3) Adjust the azimuth adjusting screws for maximum reading on the VTVM at both channels in the same way as in the Playback Head Azimuth Adjustment.

(4) Apply lock paint to the screws.

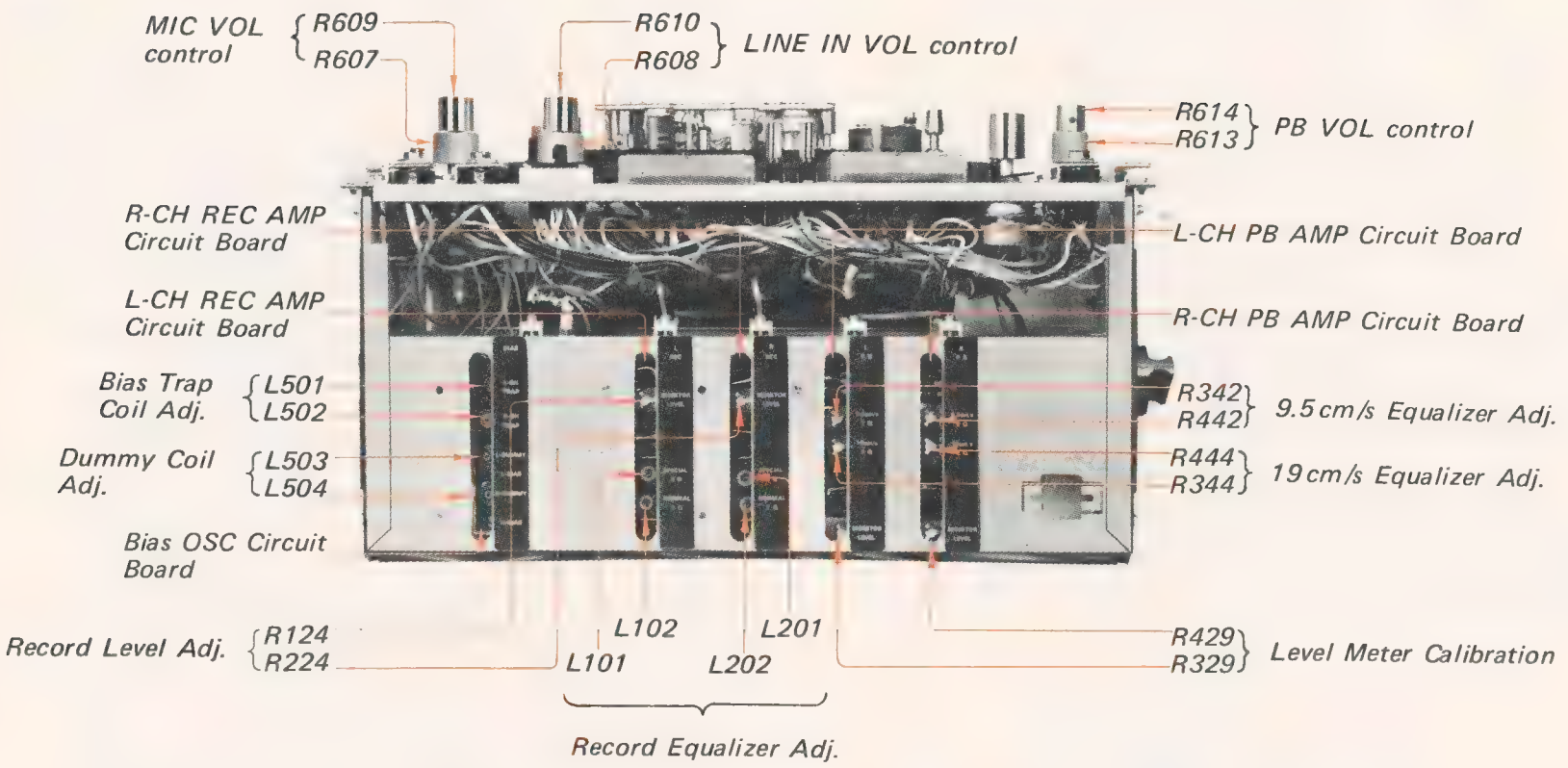


Fig. 3-3-3. Adjusting parts locations

3-3-2. Level Meter Calibration

Steps:

(1) Place the unit in FWD mode.

(2) Set the PB VOL control to the position indicated in the Precaution on page 16.

(3) Play back the first tone (400 Hz, 0 dB) of SONY alignment tape J-19-F2.

(4) Adjust R329 (R429) so that the level meter indicates 0 VU.

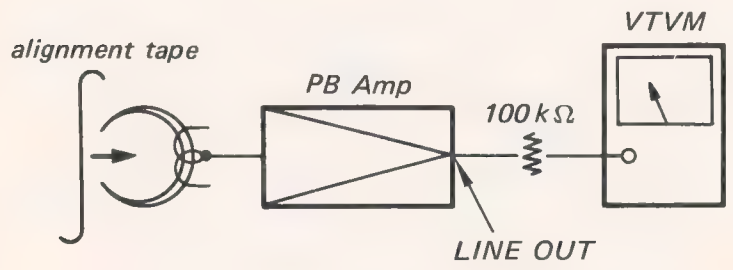


Fig. 3-3-4. Level meter calibration setup

3-3-3. PB Equalizer Adjustment

Steps:

(1) Set the TAPE SPEED switch to 19 cm/s (7½ ips).

(2) Play back the second tone (400 Hz, -10 dB) of the SONY alignment tape J-19-F2.

(3) Be sure that the VTVM indicates -10 dB (0.24 V).

(4) Play back the third tone (10 kHz, -10 dB) and the fourth tone (12.5 kHz, -10 dB) of SONY alignment tape J-19-F2.

(5) Adjust R344 (R444) so that the VTVM indicates -10 dB (0.24 V) against each frequency.

(6) Change the TAPE SPEED switch to 9.5 cm/s (3¾ ips).

(7) Play back the third tone (400 Hz, -10 dB) of SONY alignment tape J-9-F1.

(8) Be sure that the VTVM indicates -10 dB (0.24 V).

(9) Play back the fourth tone (5 kHz, -10 dB) of SONY alignment tape J-9-F1.

(10) Adjust R342 (R442) so that the VTVM indicates -10 dB (0.24 V).

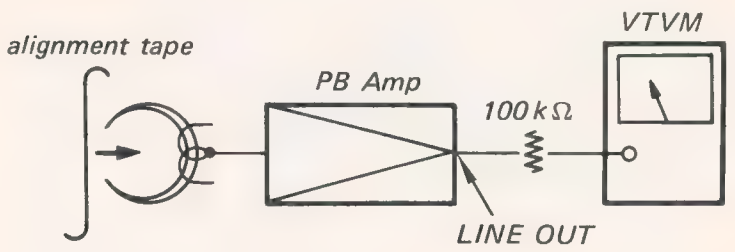


Fig. 3-3-5. PB equalizer adjustment setup

3-3-4. Dummy Coil Adjustment

Steps:

(1) Pull out the head cover upwards.

(2) Connect the VTVM across the terminal No. ③ and ⑤ (No. ④ and ⑤) of the head connector (CNJ804) as shown in Fig. 3-3-6.

(3) Place the unit in stereo-record mode.

(4) Memorize the VTVM reading.

(5) Set L-CH (R-CH) only in record mode.

(6) Adjust L503 (L504) so that the VTVM reading across the terminal No.③ and ⑤ (No.④ and ⑤) is the same as the value obtained in the step (4).

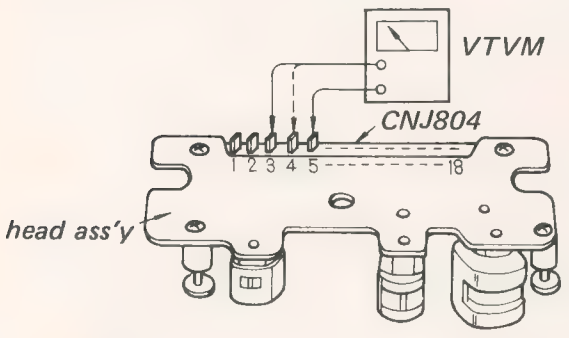


Fig. 3-3-6. Dummy coil adjustment setup

3-3-5. Bias Trap Coil Adjustment

Note: This adjustment is necessary only when the trap coil is replaced.

Turn the core until the head surface of the core is even with the upper edge of the bobbin.

3-3-6. Record Bias Adjustment

Steps:

(1) Be sure that the dummy coil adjustment has been made.

(2) Set the PB VOL control to the position indicated in the Precaution on page 16 and thread a blank tape.

(3) Deliver a 1 kHz signal of -60 dB (0.775 mV) into the MIC jack.

(4) Set the MONITOR switch to "SOURCE".

(5) Adjust the MIC volume control so that the VTVM indicates 0 dB (0.775 V).

(6) Change the MONITOR switch to "TAPE".

(7) Place the unit in stereo-record mode and record the signal on the blank tape.

(8) Turn the trimmer capacitor C511 (C512) clockwise to the full and return it several times.

(9) Turn C511 (C512) clockwise slowly, then the VTVM reading will go up and reaching a maximum, and then falling again.
Continue to turn C511 (C512) until the VTVM reads 0.5 dB below the maximum reading.

Note: After this adjustment, be sure to make the record equalizer adjustment.

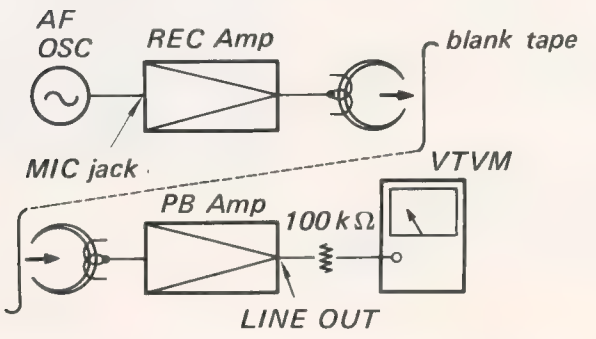


Fig. 3-3-7. Record bias adjustment setup

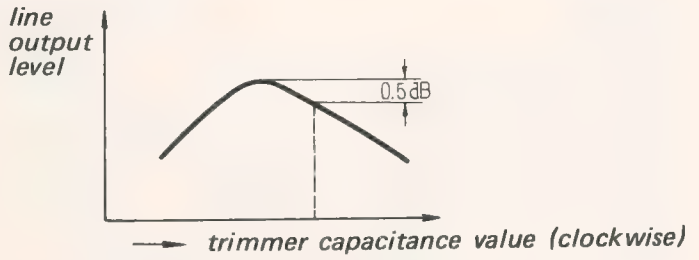


Fig. 3-3-8. Record bias characteristics

3-3-7. Record Level Adjustment

Steps:

(1) Thread a blank tape.

(2) Deliver a 1 kHz signal of -60 dB (0.775 mV) into the MIC jack.

(3) Set the MONITOR switch to "SOURCE".

(4) Adjust the MIC volume control so that the VTVM indicates 0 dB (0.775 V).

(5) Change the MONITOR switch to "TAPE".

(6) Place the unit in stereo-record mode.

(7) Adjust R124 (R224) so that the VTVM indicates 0 dB (0.775 V).

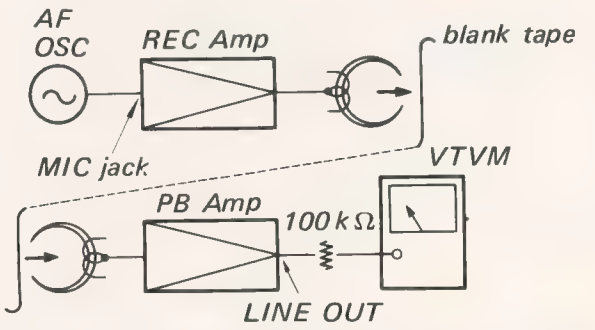


Fig. 3-3-9. Record level adjustment setup

3-3-8. Record Equalizer Adjustment

Steps:

(1) Set the TAPE SELECTOR switch to "NORMAL".

(2) Thread a blank tape.

(3) Deliver a 1 kHz signal of −20 dB (77.5 mV) into the LINE IN jack.

(4) Place the unit in stereo-record mode.

(5) Adjust the LINE IN volume control so that the VTVM indicates −20 dB (77.5 mV).

(6) Change the signal continuously from 1 kHz to 20 kHz.

(7) Adjust L_{102} (L_{202}) so that the VTVM indicates −20 dB (77.5 mV) everywhere within the range indicated.

(8) Change the TAPE SELECTOR switch to "SLH".

(9) Thread the SLH (SONY Low-noise High-output) tape as a blank tape.

(10) Deliver a 1 kHz signal of −20 dB (77.5 mV) into the LINE IN jack.

(11) Place the unit in stereo-record mode.

(12) Adjust the LINE IN volume control so taht the VTVM indicates −20 dB (77.5 mV).

(13) Change the signal continuously from 1 kHz to 20 kHz.

(14) Adjust L_{101} (L_{201}) so that the VTVM indicates −20 dB (77.5 mV) everywhere within the range indicated.

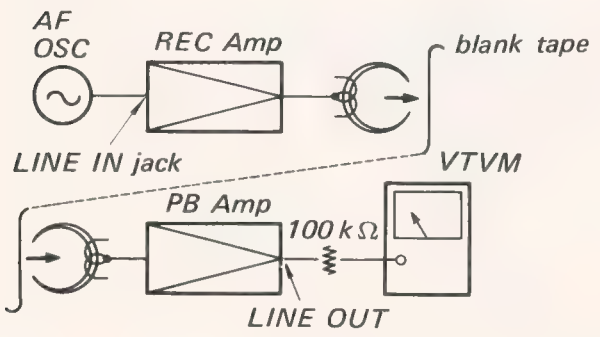


Fig. 3-3-10. Record equalizer adjustment setup

3-4. CHANGING FROM 4-TRACK TO 2-TRACK RECORDING AND VICE VERSA

In the TC-650 the recording system can be changed from 4-track to 2-track and vice versa, by replacing a head assembly. Proceed as follows referring to the figures.

Note: After the head assembly has been replaced, be sure to make the record bias adjustment.

Head Assembly Replacement

Steps:

(1) Remove the Head Cover.

(2) Remove two screws which secure the Head Assembly as shown in Fig. 3-4-1.

(3) Lift the 4-track (2-track) Head Assembly out of the Head Deck.

(4) Install the 2-track (4-track) Head Assembly.

(5) Secure the Head Assembly with the two screws.

(6) Install the Head Cover.

	Part No.
2-track head ass'y:	H17-2S
4-track head ass'y:	H17-4S

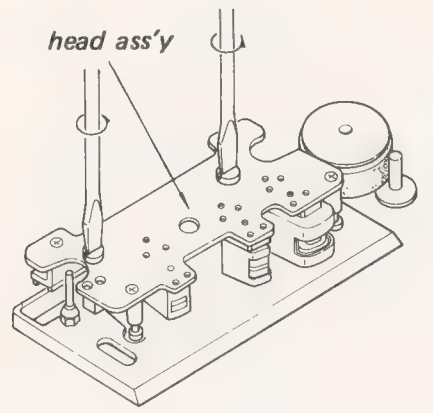


Fig. 3-4-1. Head ass'y removal

(7) Remove the Ventilator horizontally by taking off the four screws as shown in Fig. 3-4-2.

(8) Perform the record bias adjustment (See page 18).

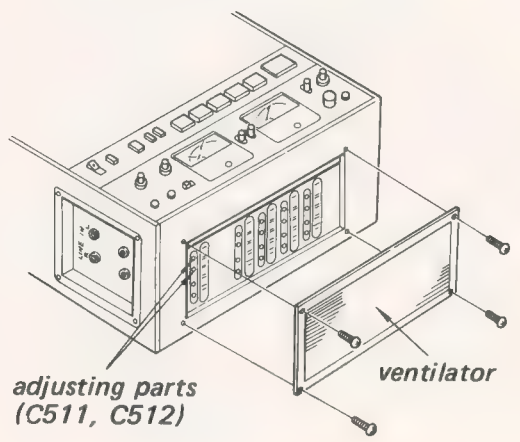
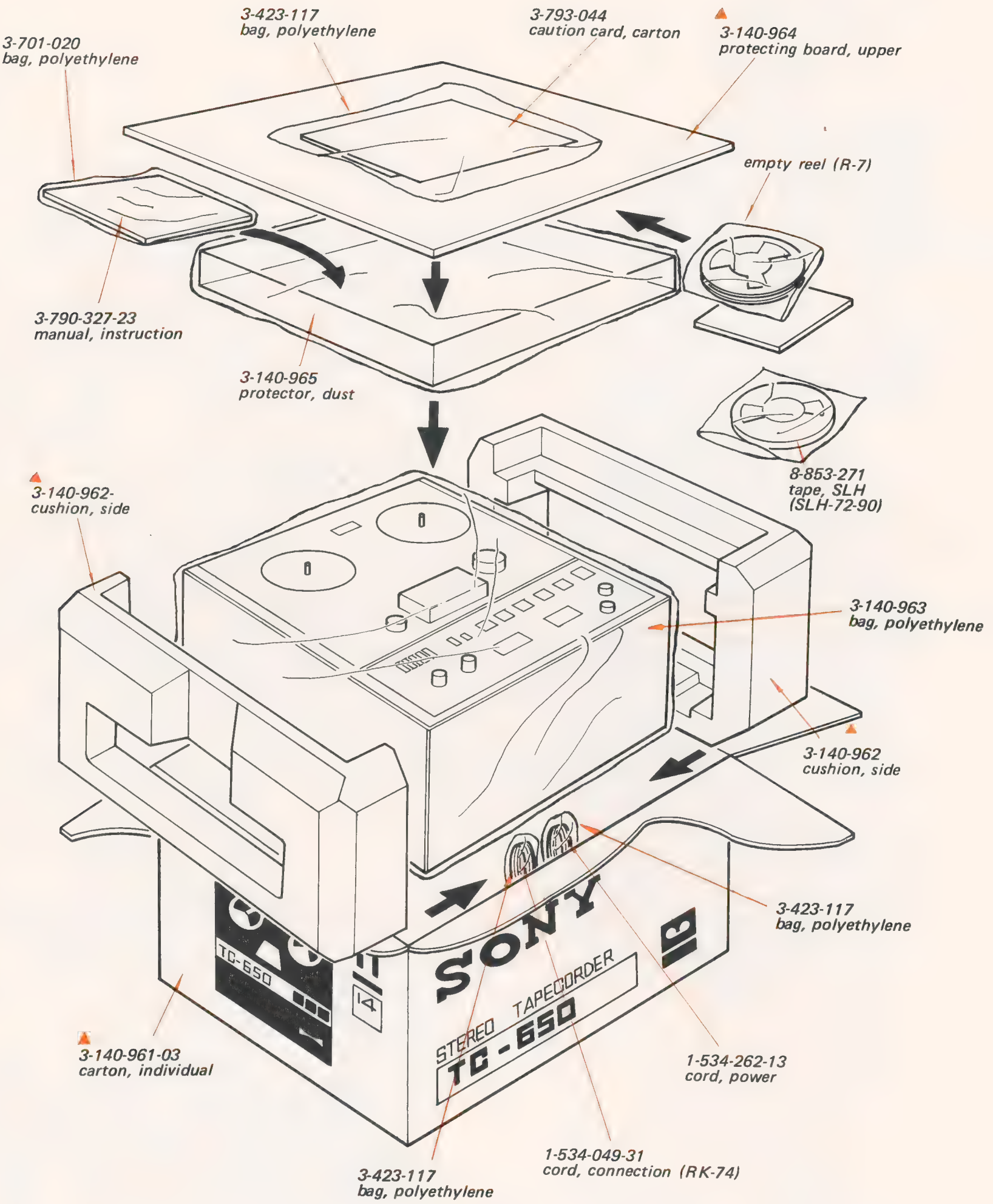


Fig. 3-4-2. Ventilator removal

SECTION 4
REPACKING

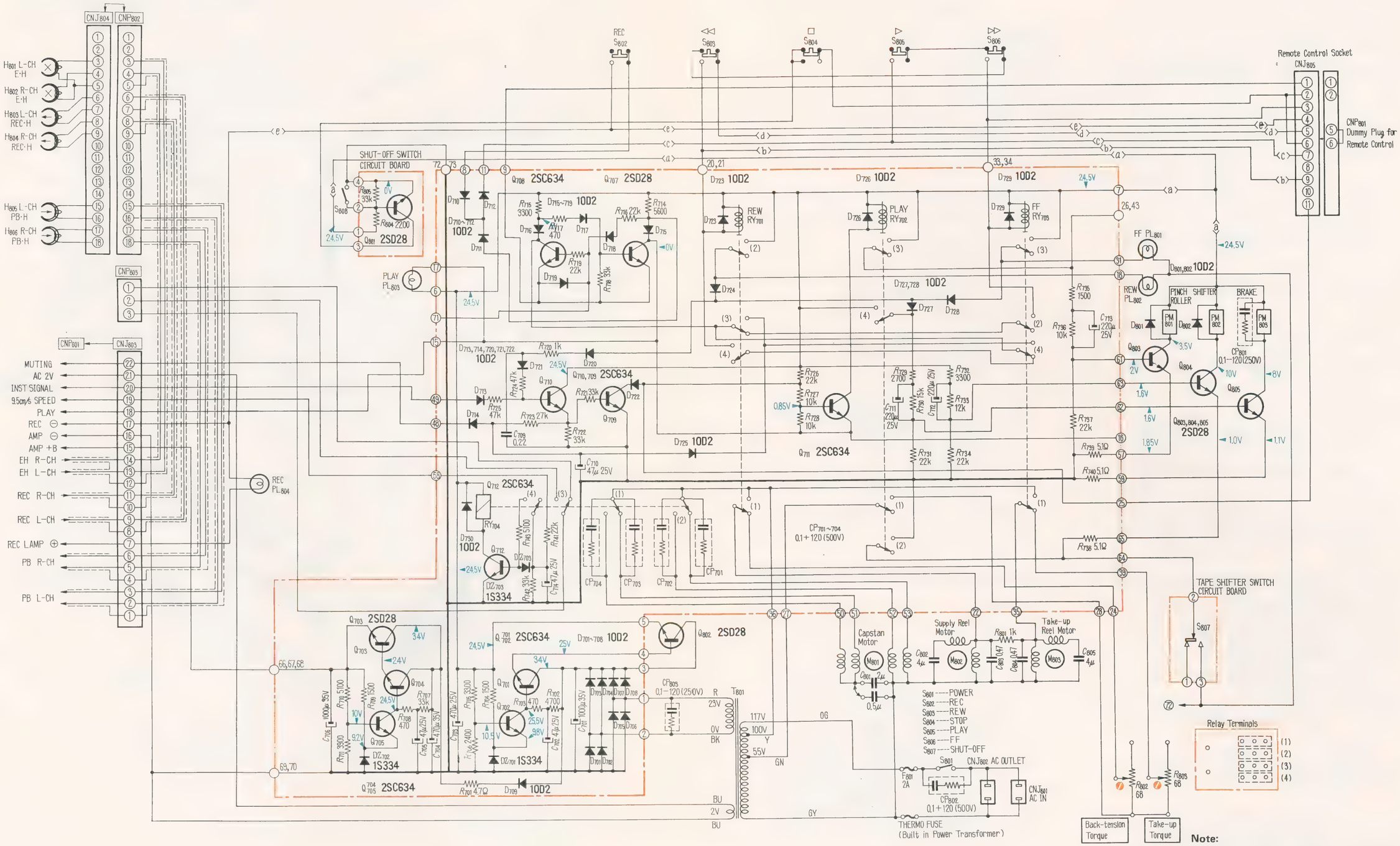


Parts marked with ▲are included in carton ass'y (X-31428-19).

SECTION 5
DIAGRAMS

5-1. SCHEMATIC DIAGRAM

System Control Circuit
Up to Serial No. 10,100



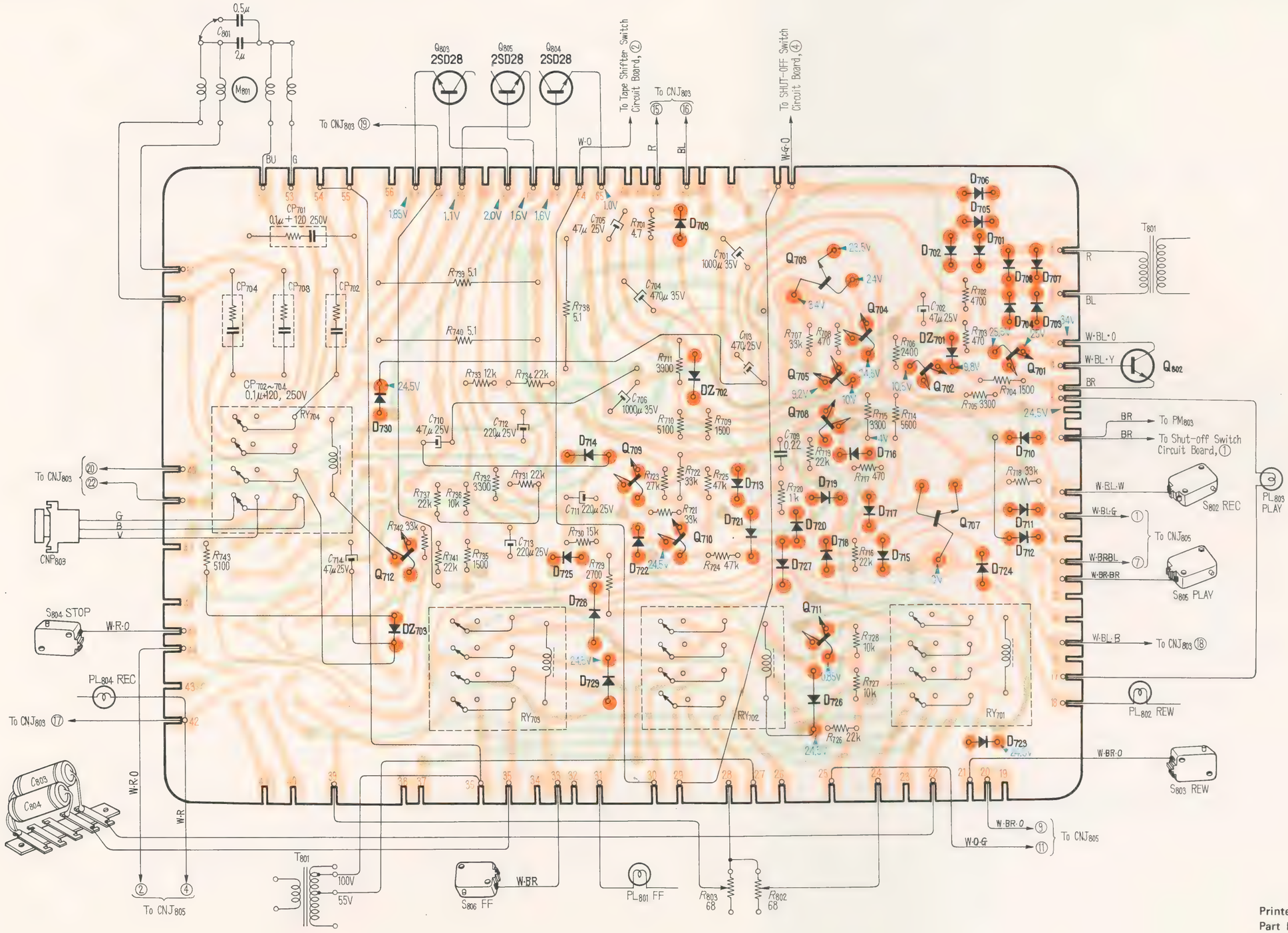
Note:

1. All resistors and capacitors are rated in Ω and μF unless otherwise specified.
2. Voltage values shown are measured with a voltmeter (20 kΩ/V) with no signal input in playback mode.
3. ⊘ : adjustable

5-2. MOUNTING DIAGRAM

System Control Circuit Board
Up to Serial No. 10,100

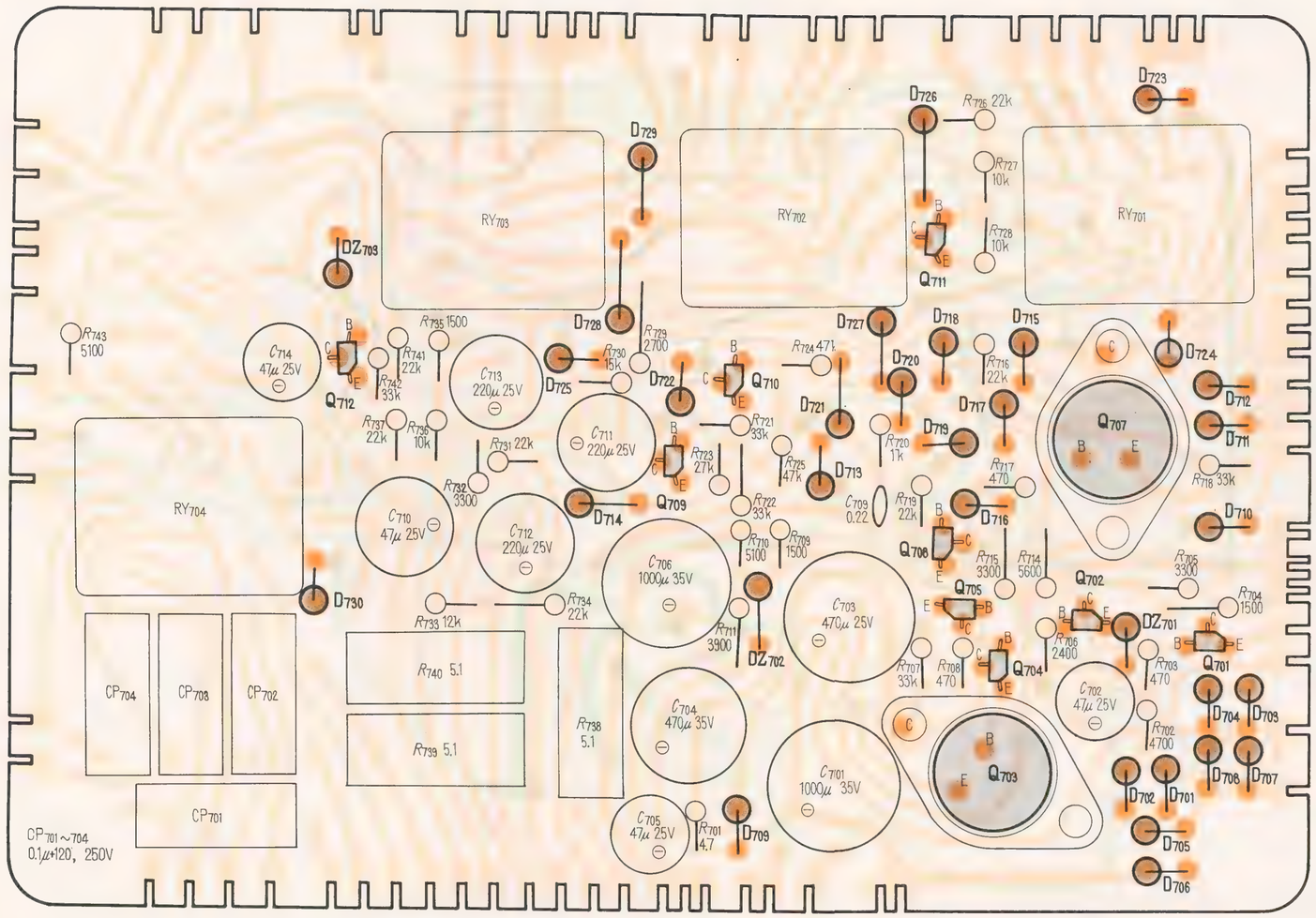
— Conductor Side —



Printed Circuit Board
Part No. 1-539-486-11

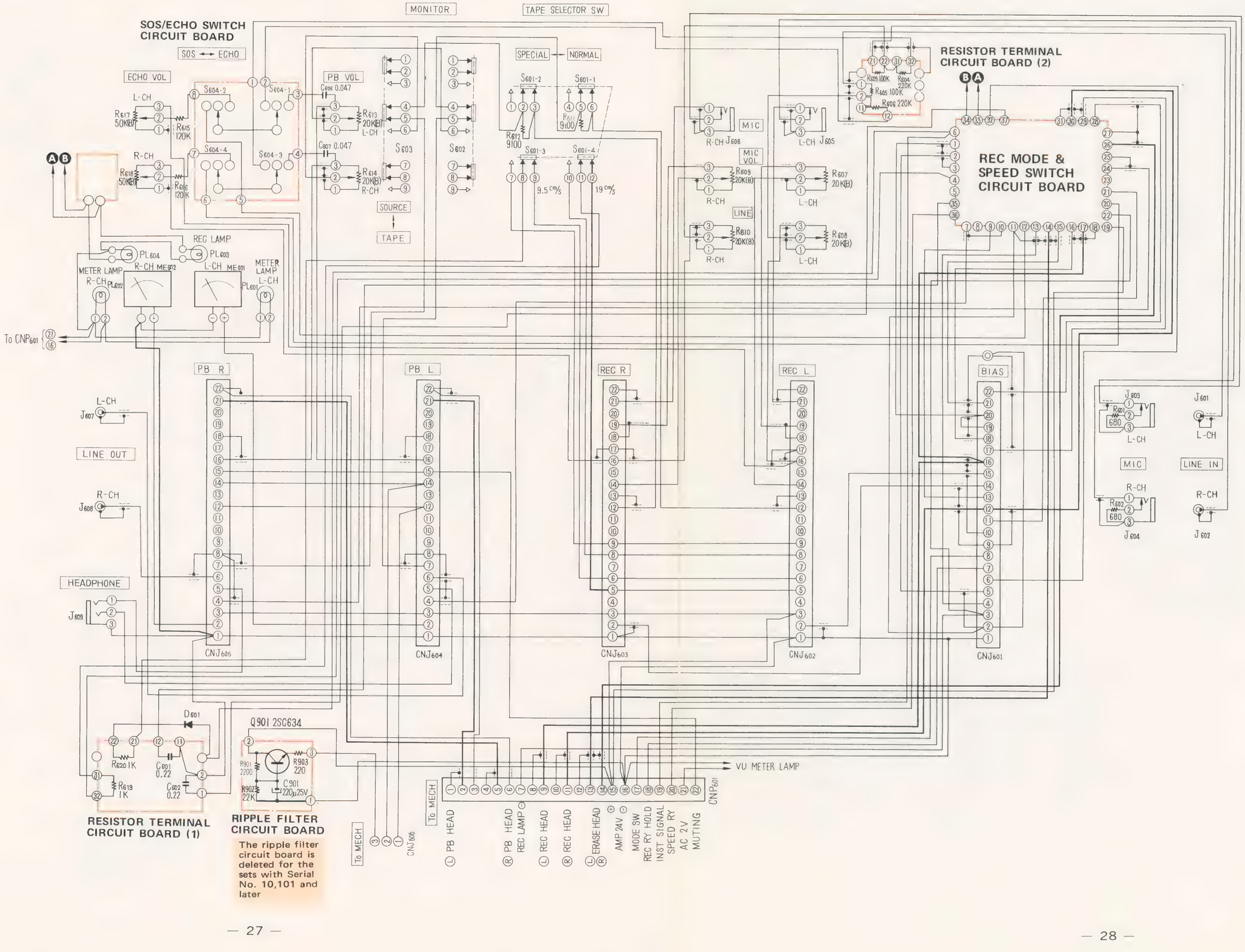
System Control Circuit Board
Up to Serial No. 10,100

– Component Side –



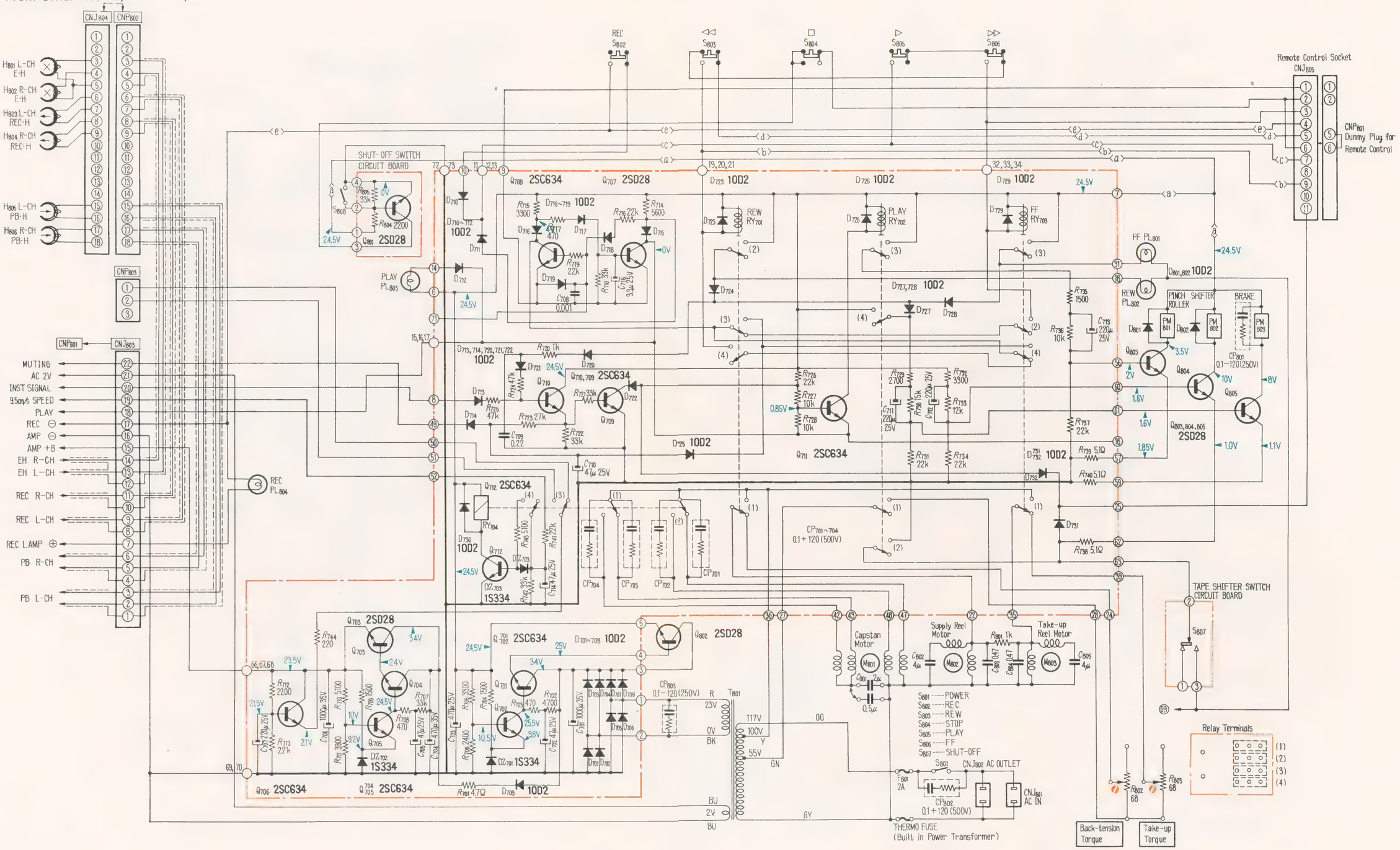
SCHEMATIC DIAGRAM

Amp. Chassis Circuit



5-4. SCHEMATIC DIAGRAM

System Control Circuit
From Serial No. 10,101 to 11,536



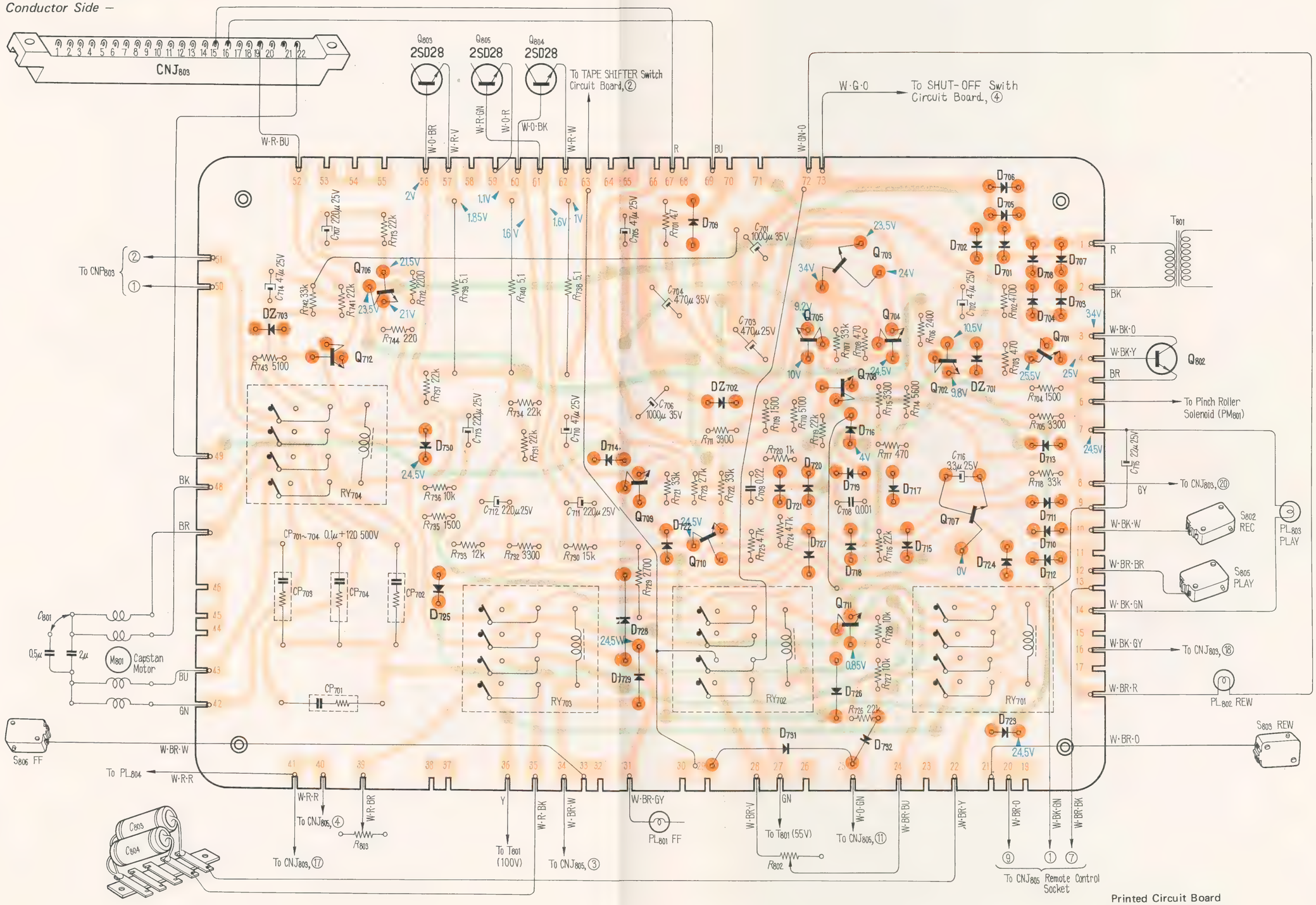
Note:

1. All resistors and capacitors are rated in Ω and μF unless otherwise specified.
2. Voltage values shown are measured with a volt-meter (20 kΩ/V) with no signal input in playback mode.
3. ◢ : adjustable

5-5. MOUNTING DIAGRAM

System Control Circuit Board
From Serial No. 10,101 to 11,536

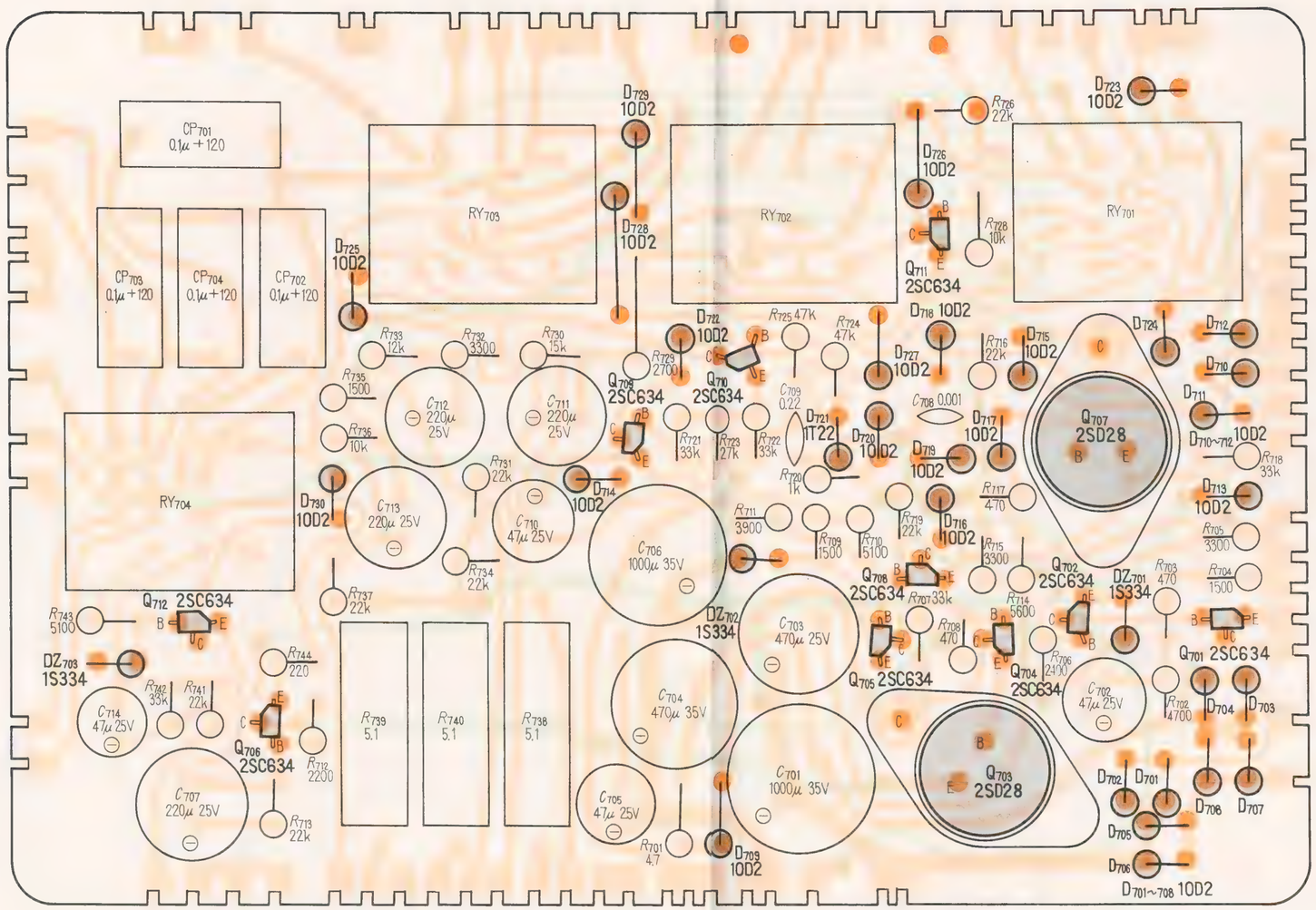
– Conductor Side –



Printed Circuit Board
Part No.: 1-539-486-12

System Control Circuit Board
From Serial No. 10,101 to 11,536

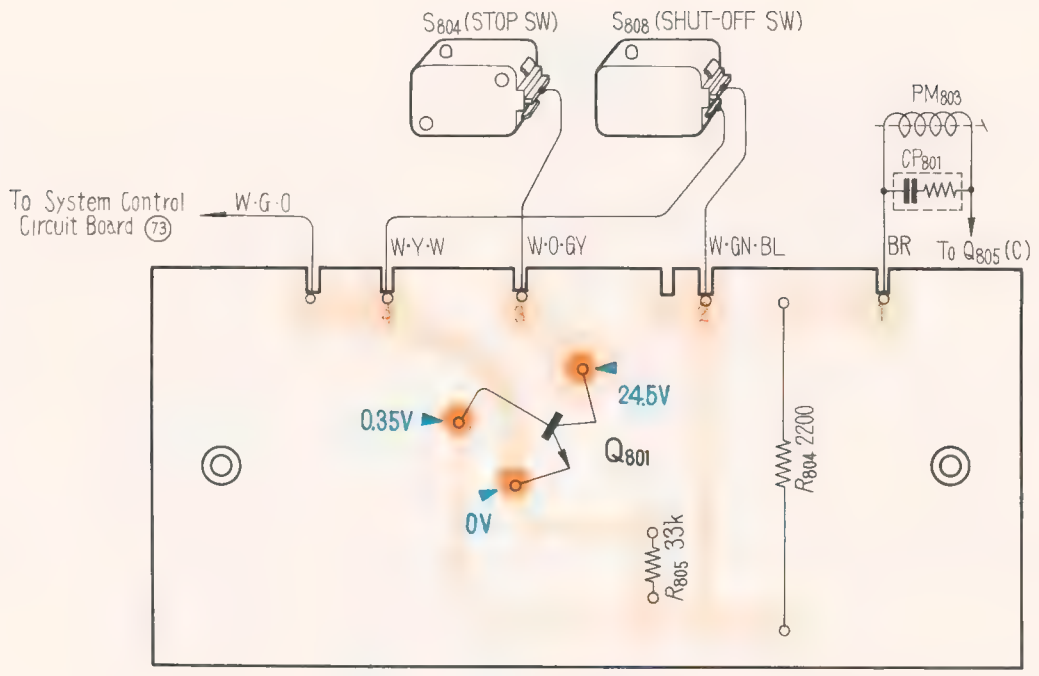
– Component Side –



5-6. MOUNTING DIAGRAM

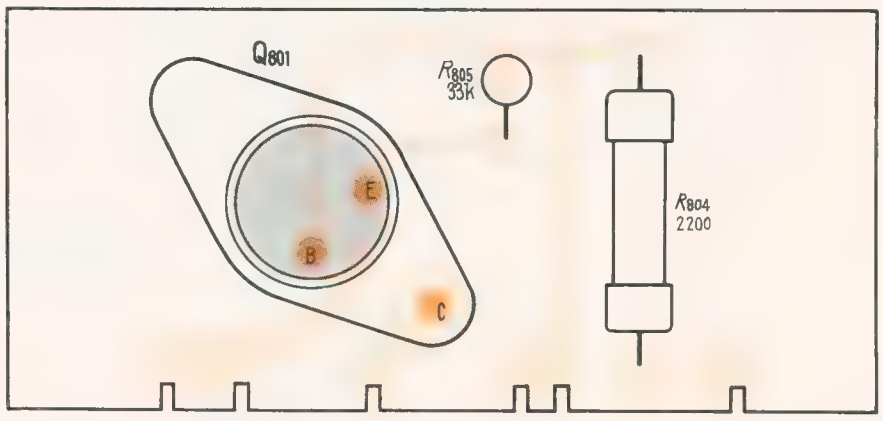
5-6-1. SHUT-OFF Switch Circuit Board

– Conductor Side –



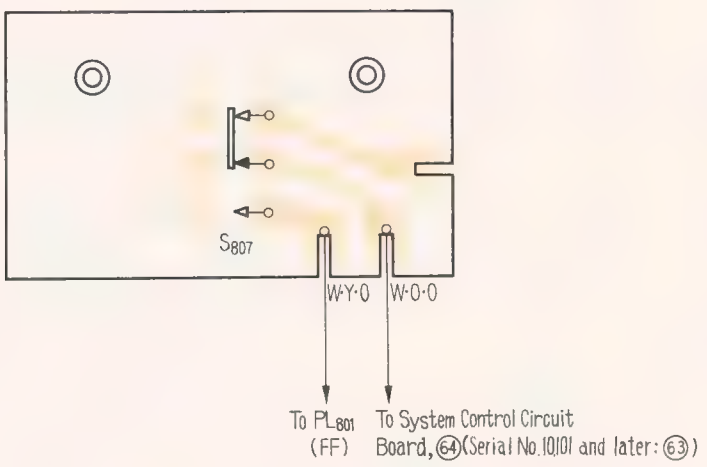
Printed Circuit Board
Part No.: 1-539-485-11

– Component Side –



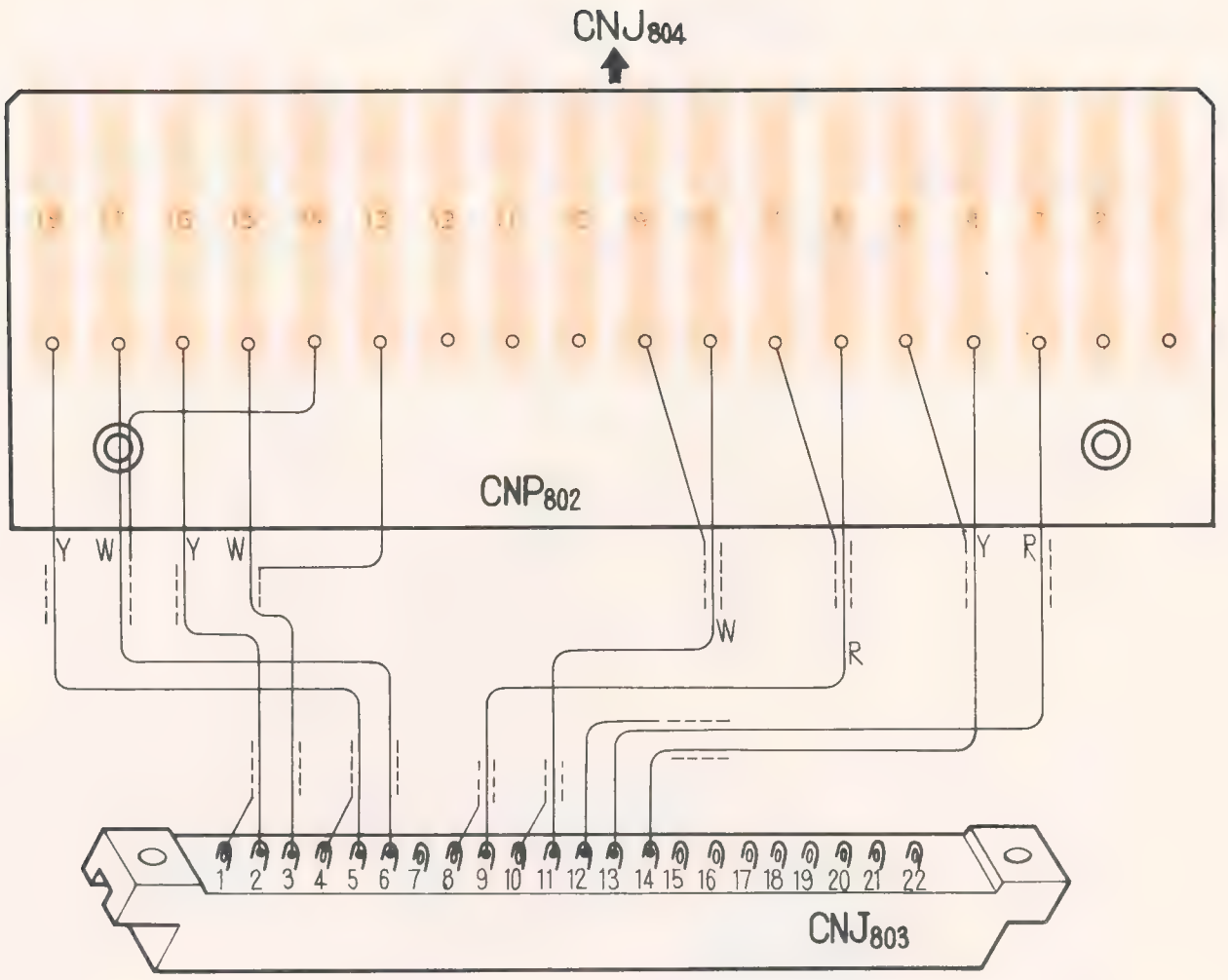
5-6-2. Tape Shifter Switch Circuit Board

– Conductor Side –



Printed Circuit Board
Part No.: 1-539-438-12

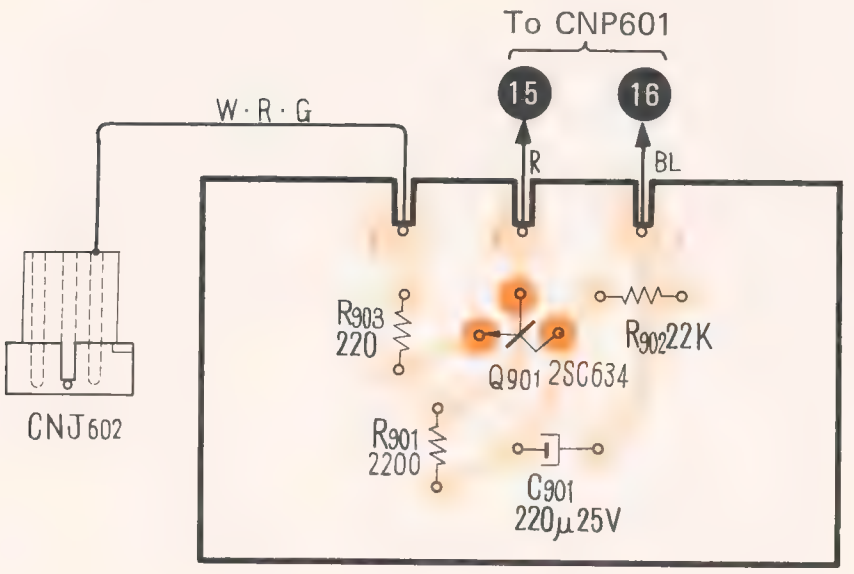
5-6-3. Head Connector Circuit Board



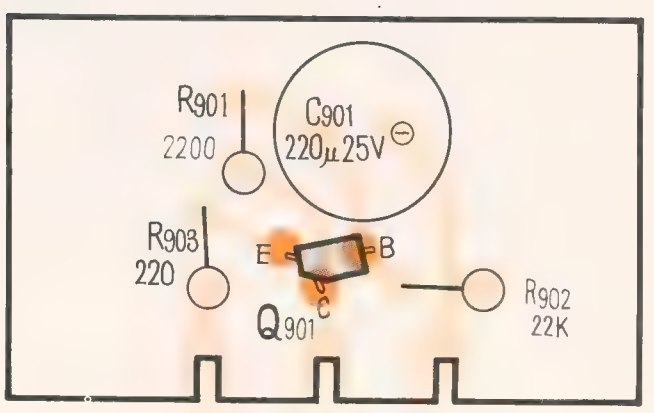
Printed Circuit Board
Part No.: 1-539-436-11

5-6-4. Ripple Filter Circuit Board
Up to Serial No. 10,100

– Conductor Side –



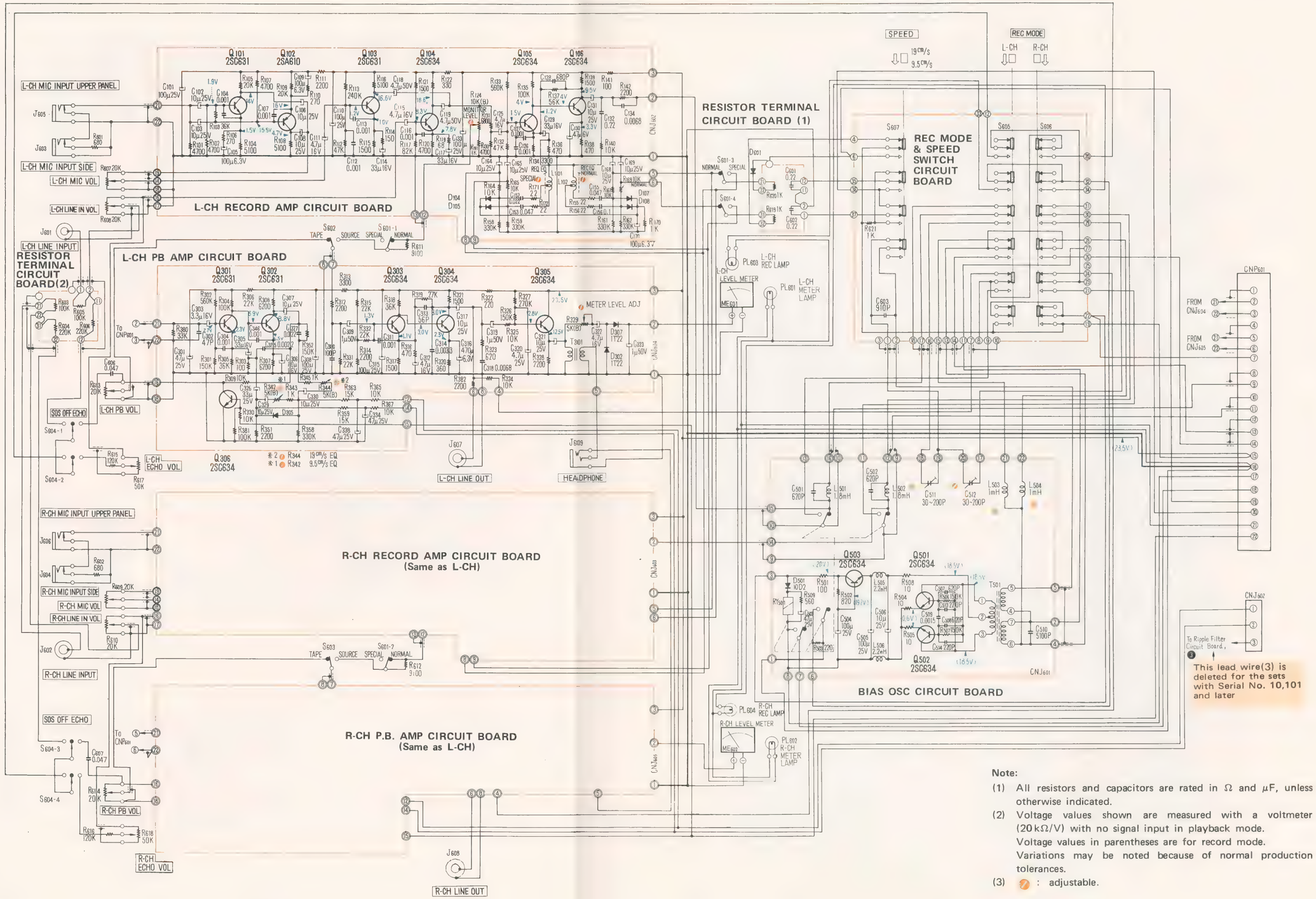
– Component Side –



Printed Circuit Board
Part No.: 1-539-433-11

5-7. SCHEMATIC DIAGRAM

Audio Amp. & Bias OSC Circuit



Note:

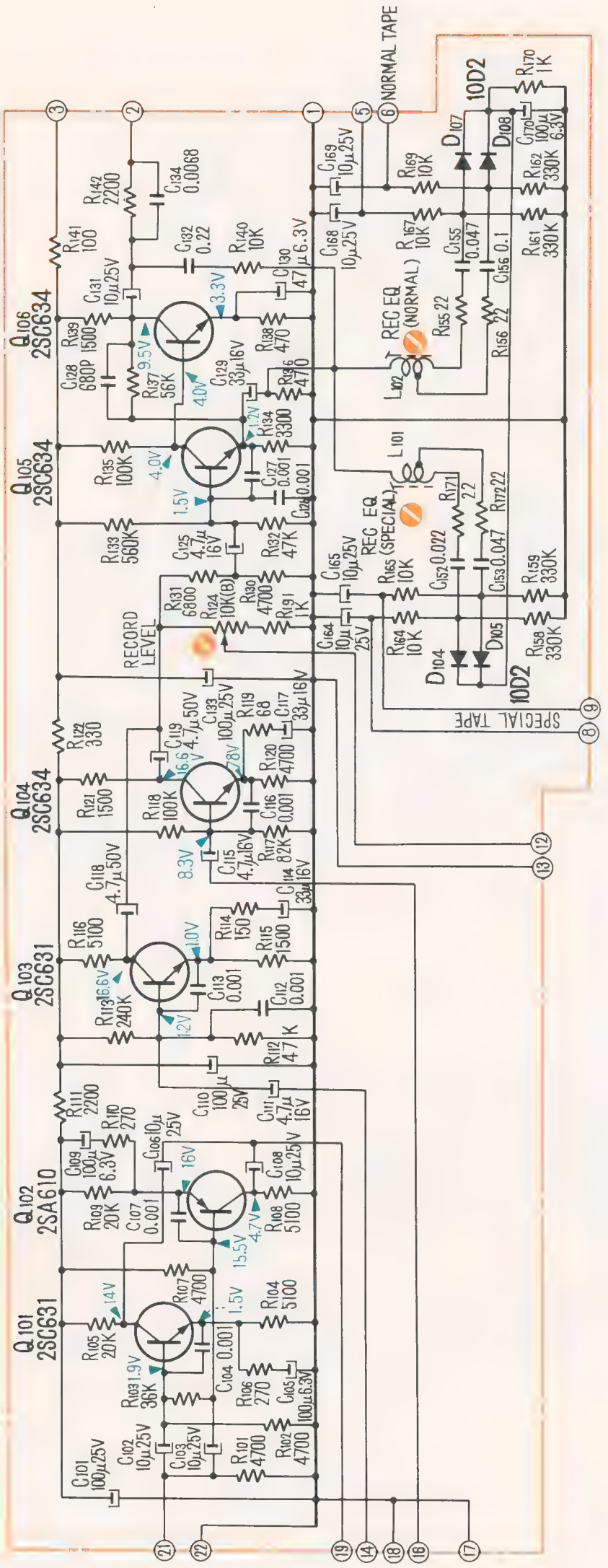
(1) All resistors and capacitors are rated in Ω and μF, unless otherwise indicated.

(2) Voltage values shown are measured with a voltmeter (20 kΩ/V) with no signal input in playback mode.
Voltage values in parentheses are for record mode.
Variations may be noted because of normal production tolerances.

(3) ❷ : adjustable.

5-8. SCHEMATIC DIAGRAM

REC AMP Circuit



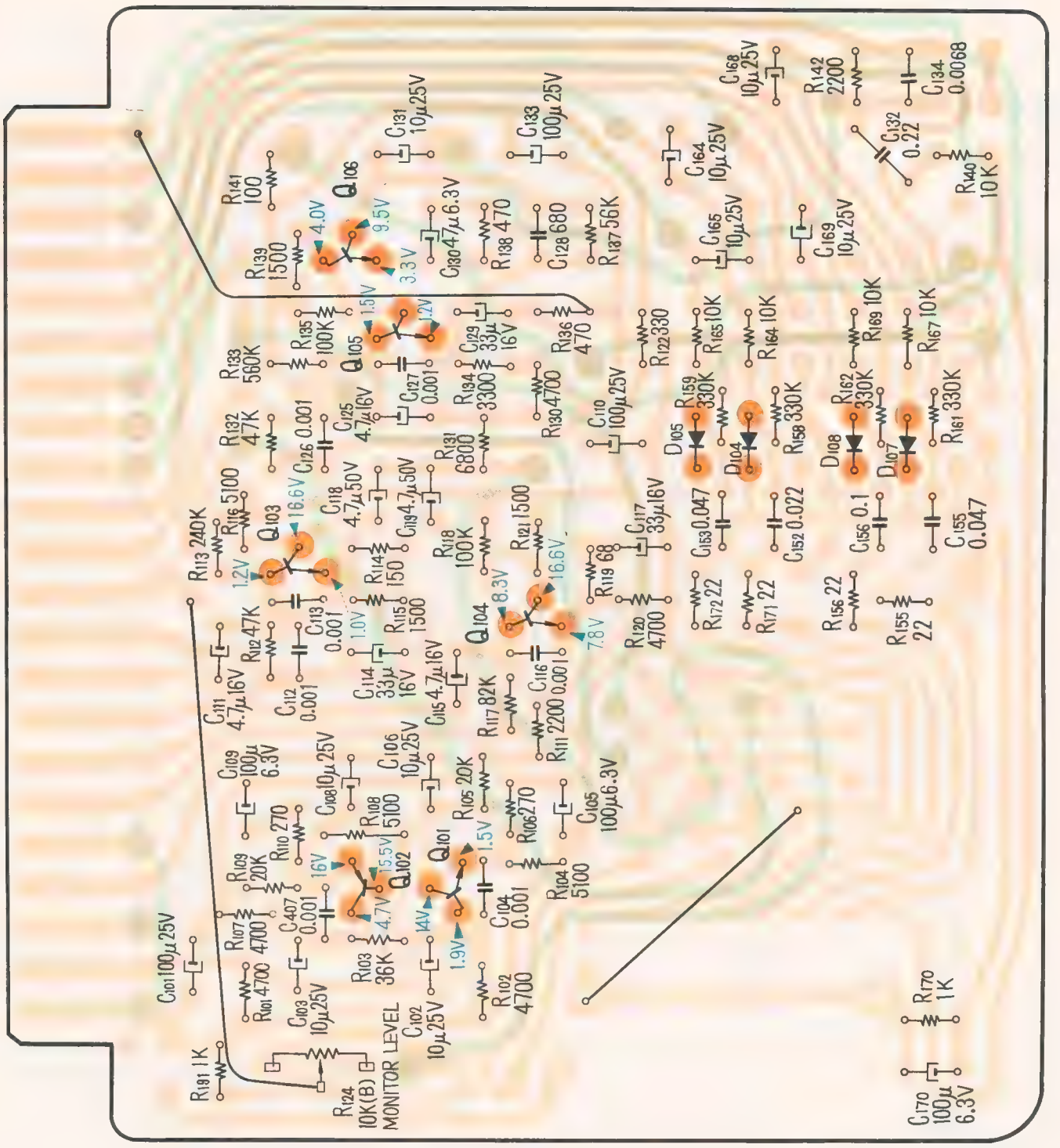
Note:

1. All resistors and capacitors are rated in Ω and μF unless otherwise specified.
2. The letter (B) suffixed to rating value of semi-fixed resistor indicates its characteristic.
3. Voltage values shown are measured with a voltmeter (20 kΩ/V) with no signal input in record mode.
4. : adjustable

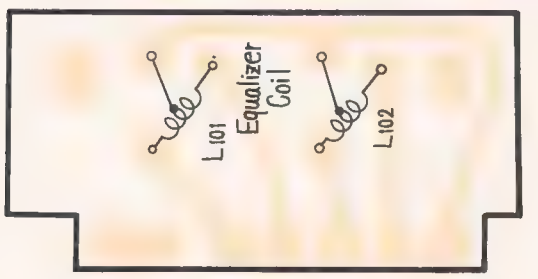
5-9. MOUNTING DIAGRAM

REC AMP Circuit Board

– Conductor Side –



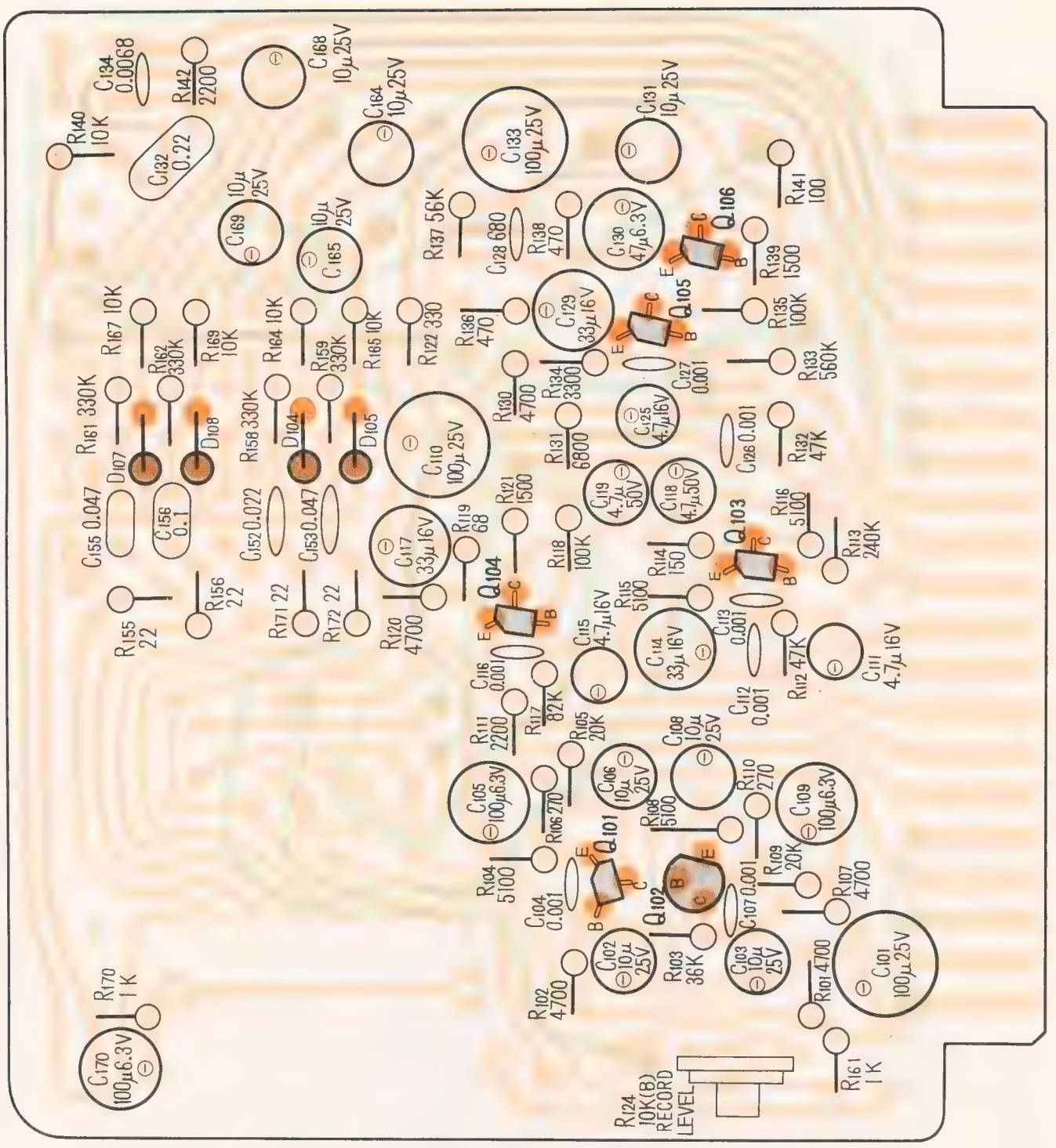
Printed Circuit Board
Part No.: 1-539-431-11

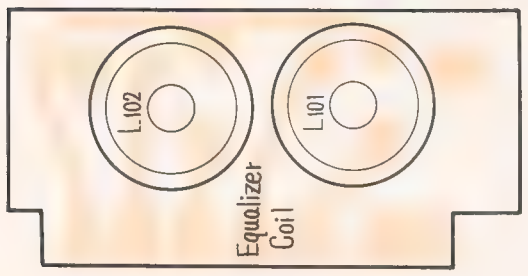


Printed Circuit Board
Part No.: 1-539-432-11

REC AMP Circuit Board

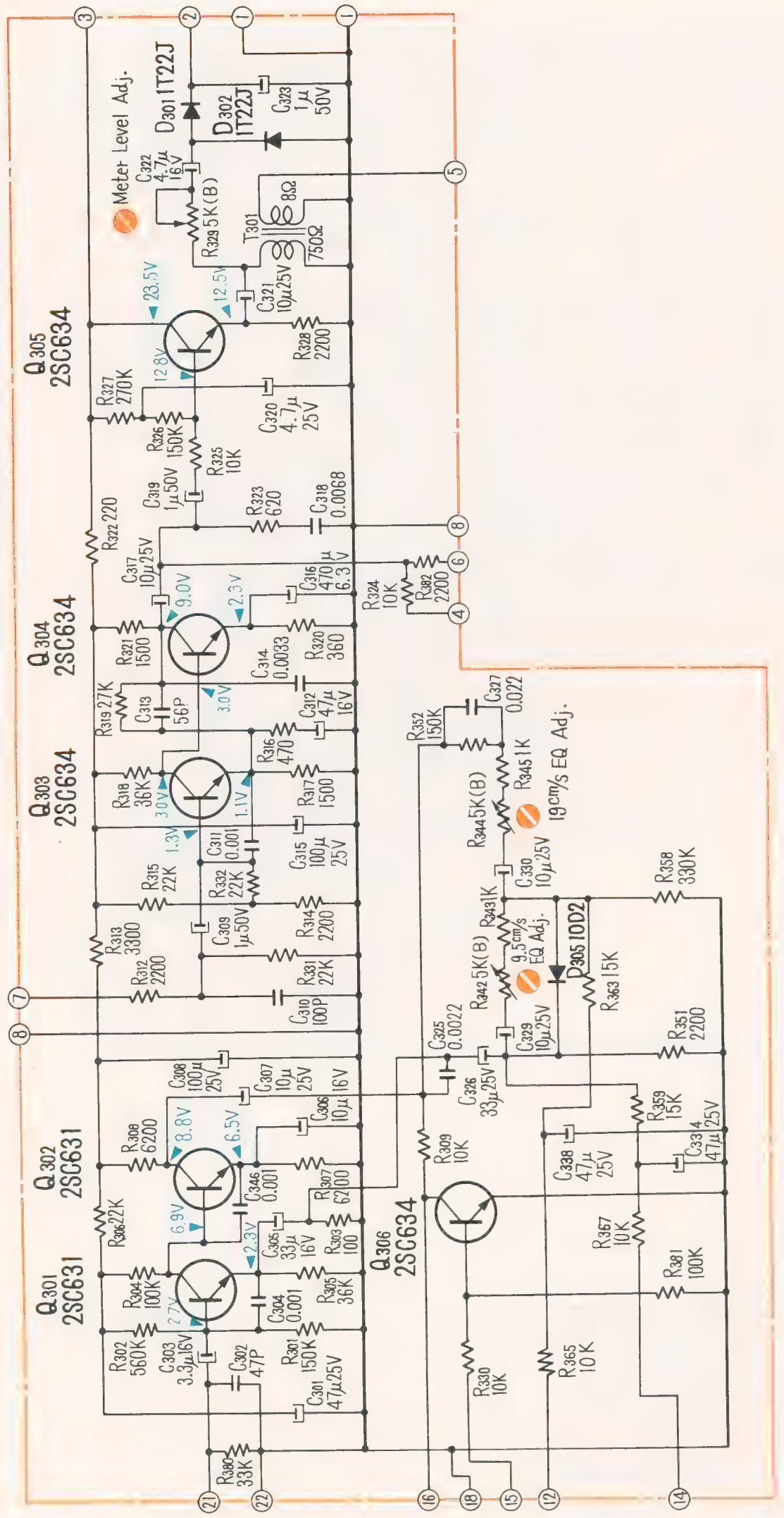
– Component Side –





5-10. SCHEMATIC DIAGRAM

PB AMP Circuit



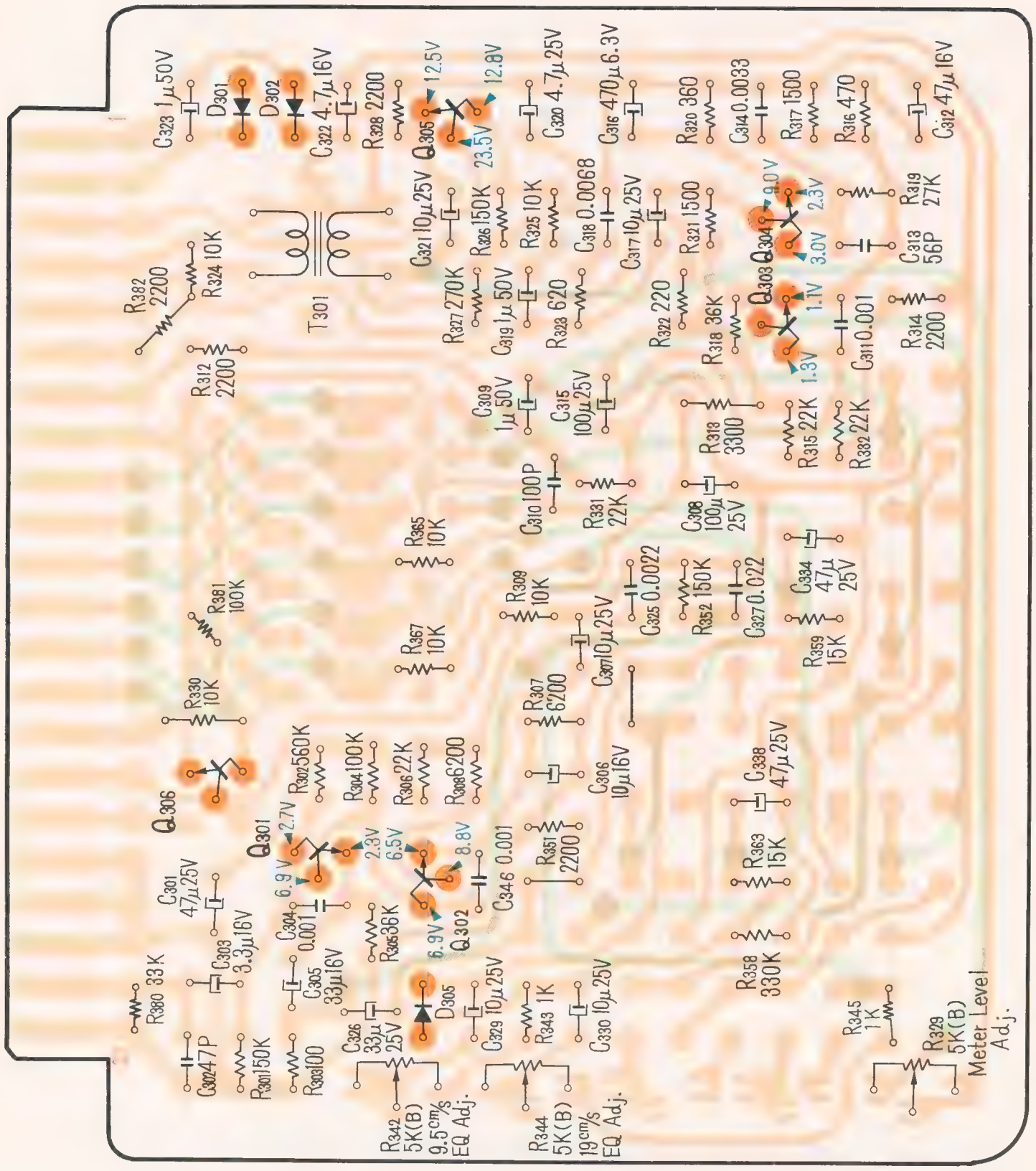
Note:

1. All resistors and capacitors are rated in Ω and μF unless otherwise specified.
2. The letter (B) suffixed to rating value of semi-fixed resistor indicates its characteristic.
3. Voltage values shown are measured with a voltmeter (20 kΩ/V) with no signal input in playback mode.
4. ⊘ : adjustable.

5-11. MOUNTING DIAGRAM

PB AMP Circuit Board

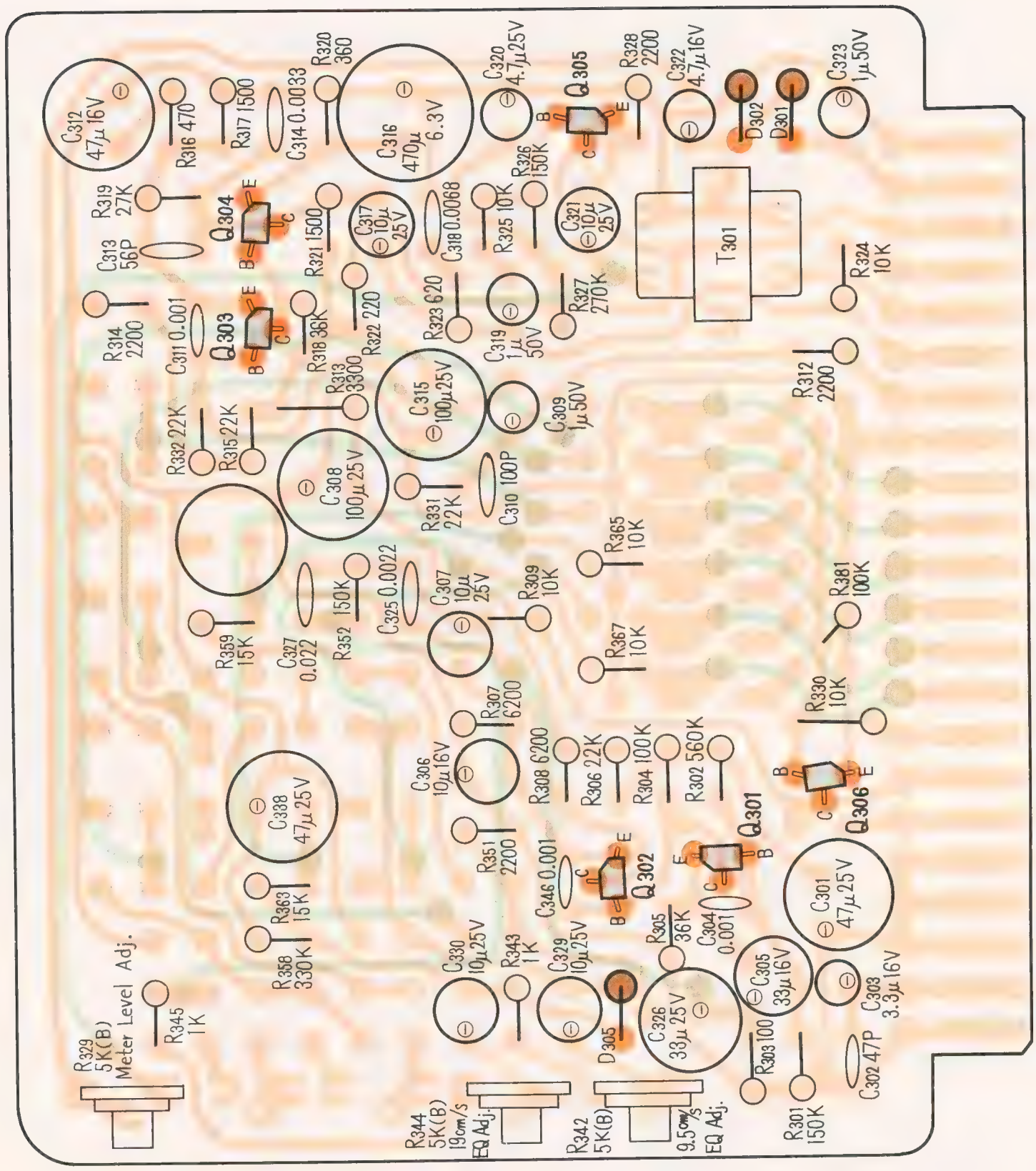
– Conductor Side –



Printed Circuit Board
Part No.: 1-539-444-11

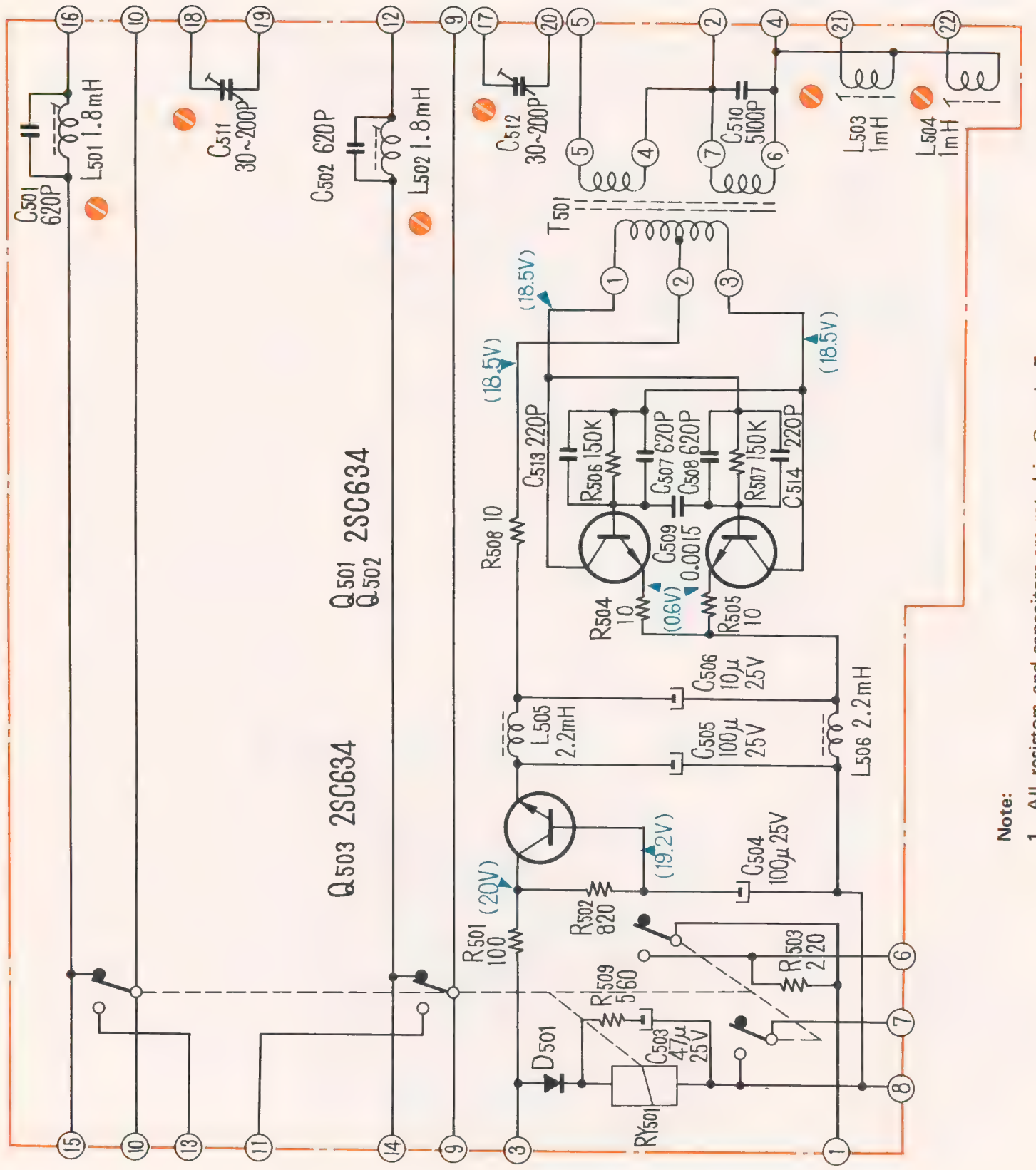
PB AMP Circuit Board

– Component Side –



5-12. SCHEMATIC DIAGRAM

Bias OSC Circuit



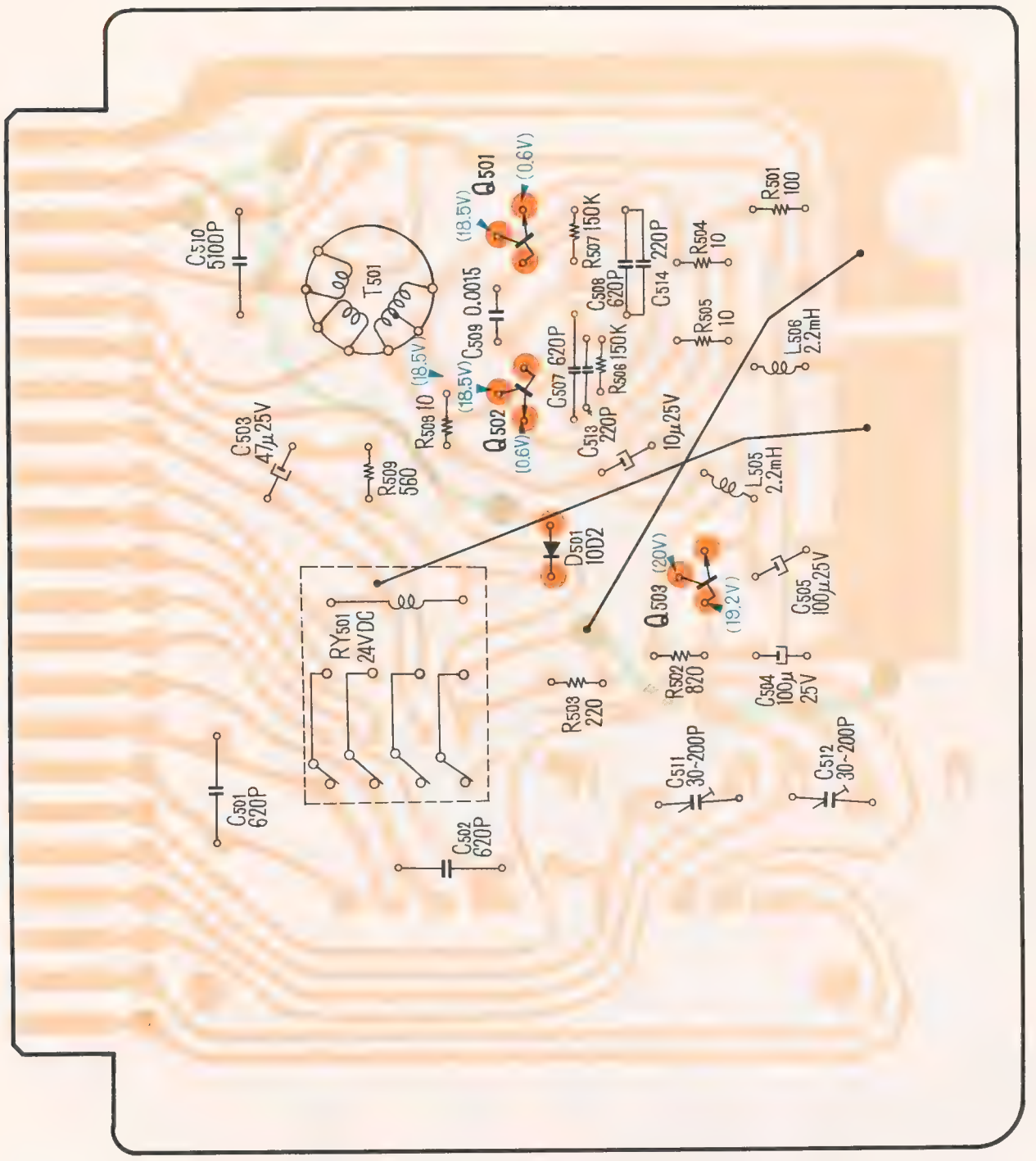
Note:

1. All resistors and capacitors are rated in Ω and μF unless otherwise specified.
2. Voltage values shown are measured with a voltmeter (20 kΩ/V) with no signal input in record mode.
3. ⊘ : adjustable.

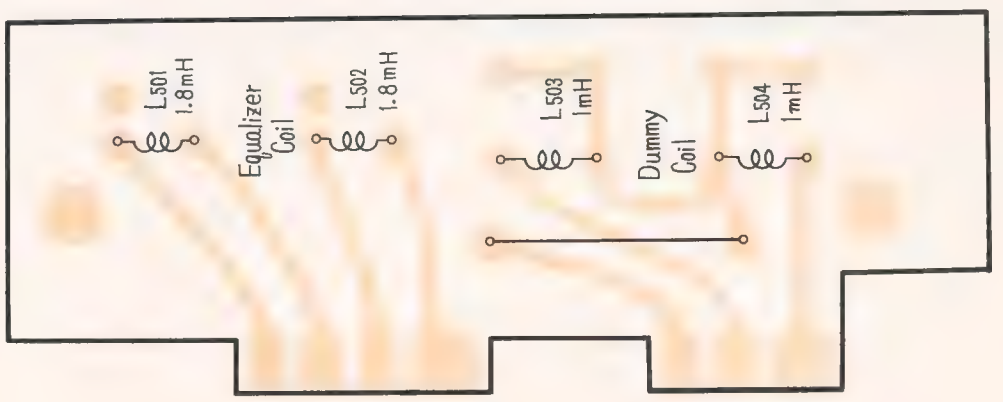
5-13. MOUNTING DIAGRAM

Bias OSC Circuit Board

– Conductor Side –



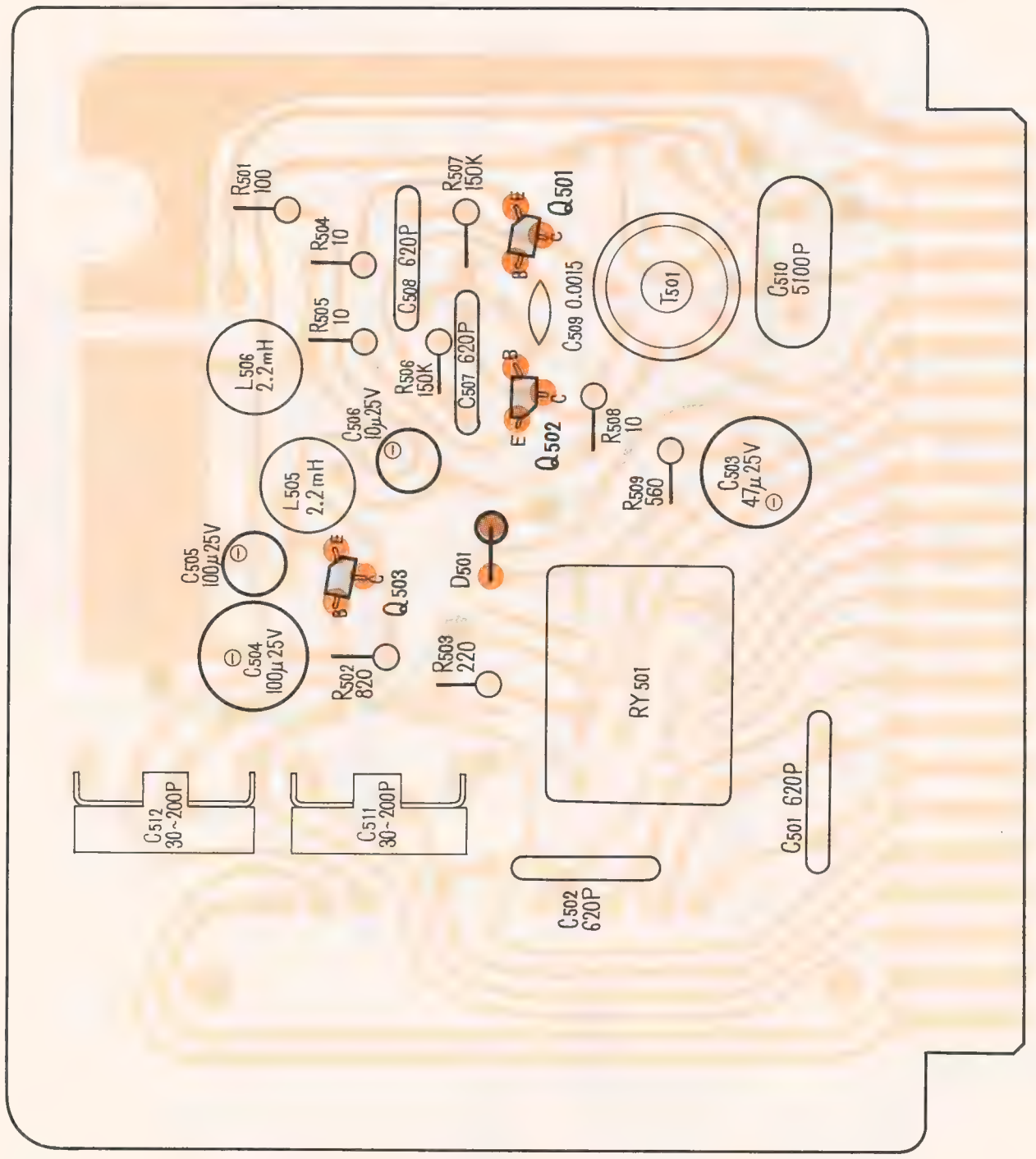
Printed Circuit Board
Part No.: 1-539-440-11

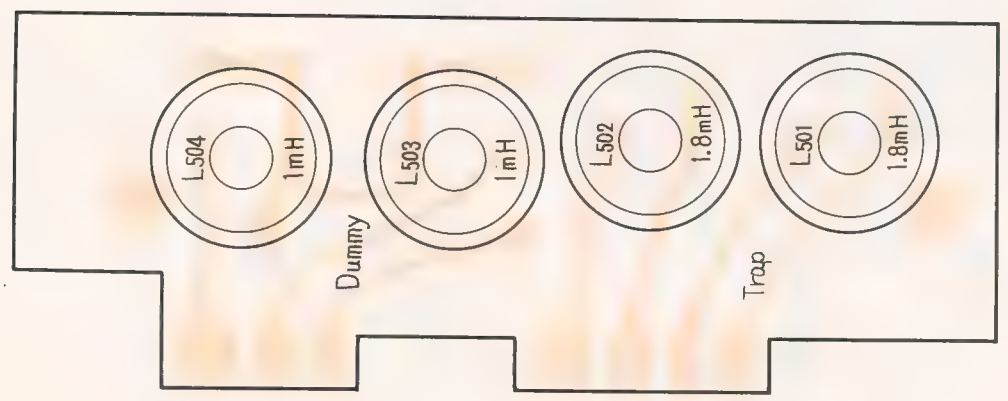


Printed Circuit Board
Part No.: 1-539-441-11

Bias OSC Circuit Board

– Component Side –



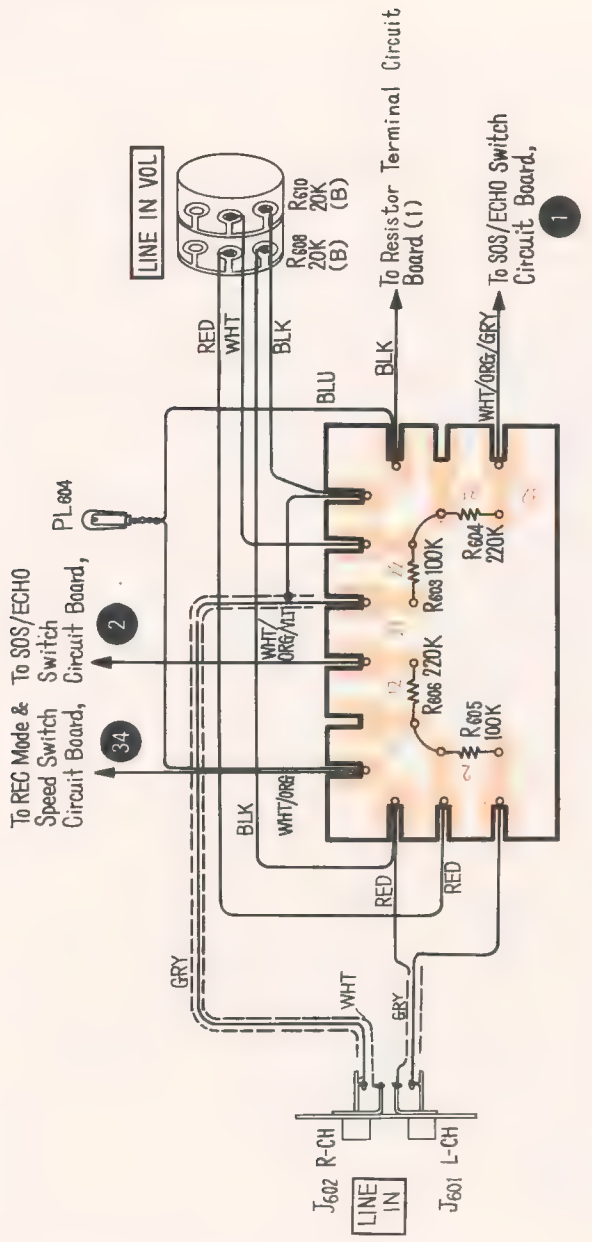


5-14. MOUNTING DIAGRAM

Resistor Terminal Circuit Board

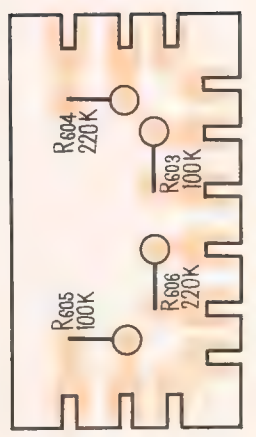
(2)

— Conductor Side —

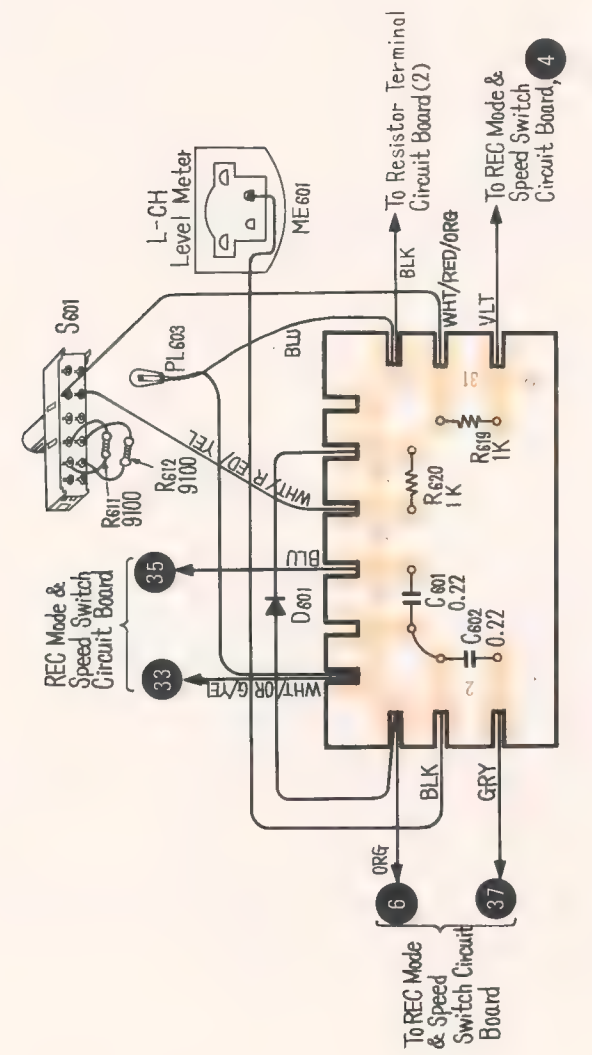


Printed Circuit Board
Part No.: 1-539-435-11

— Component Side —

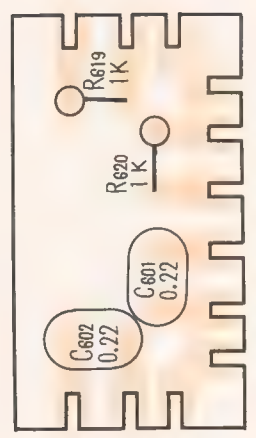


(1)



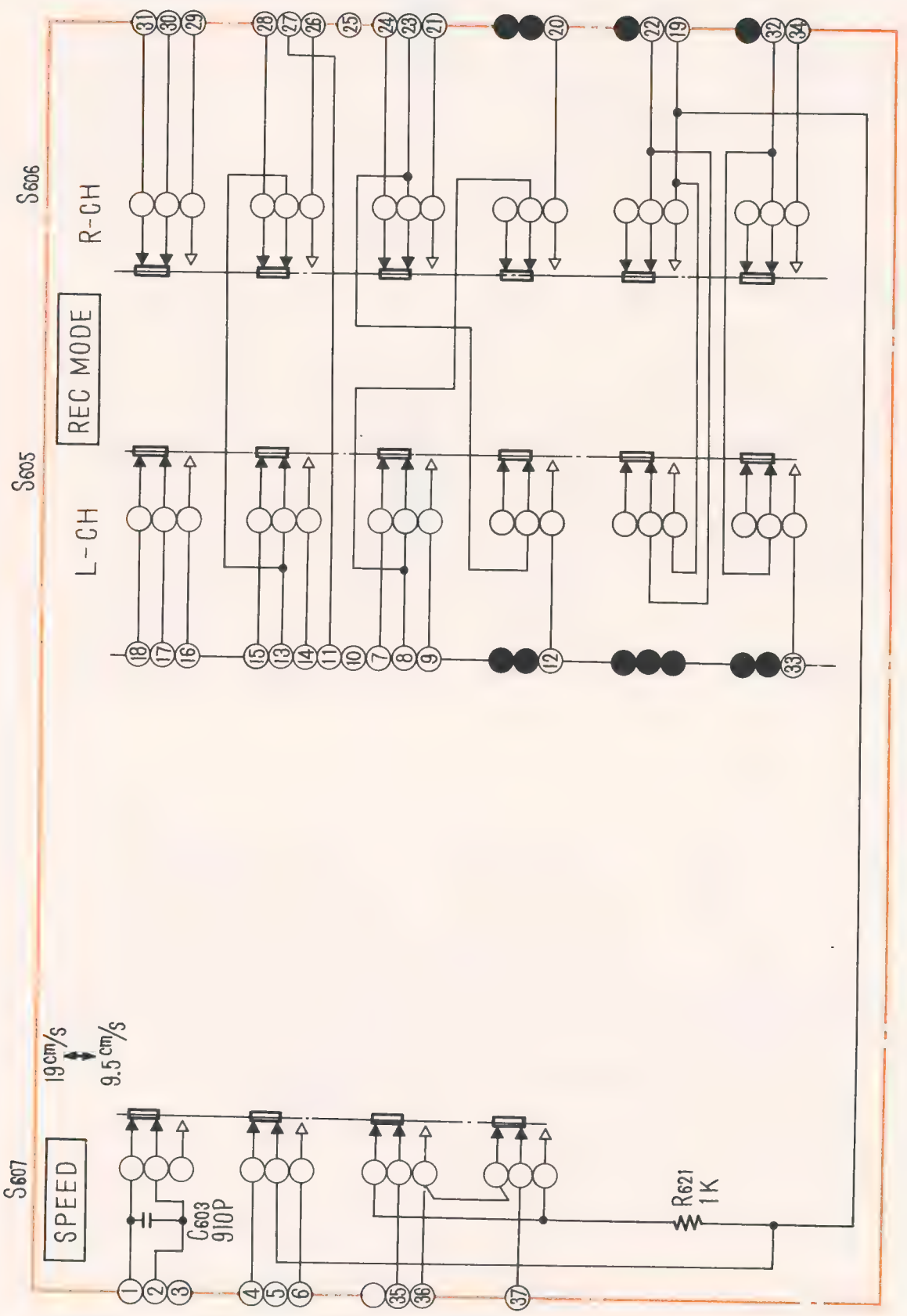
Printed Circuit Board
Part No.: 1-539-435-11

— Component Side —



5-15. SCHEMATIC DIAGRAM

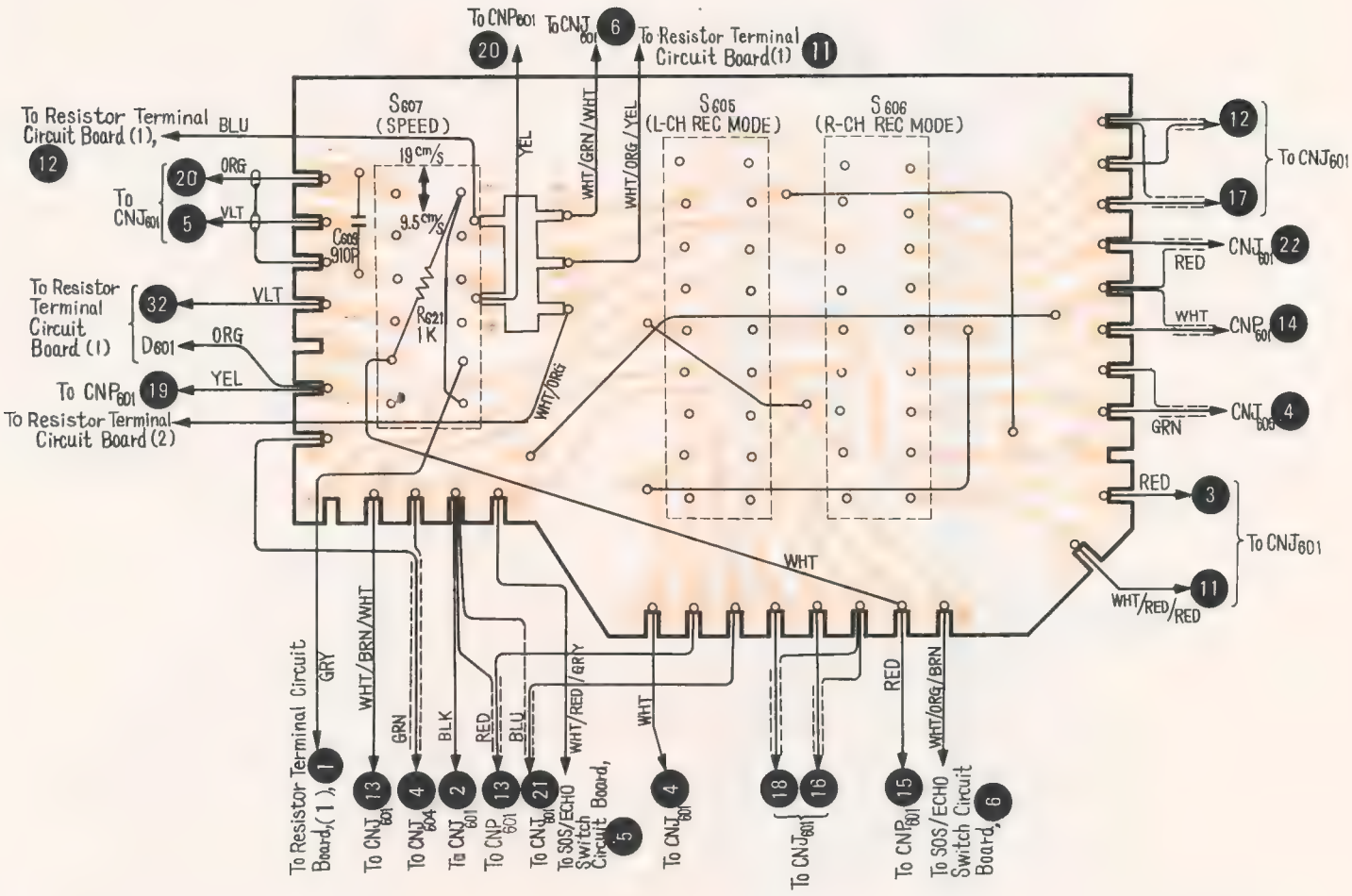
REC MODE & SPEED Switch Circuit



5-16. MOUNTING DIAGRAM

REC MODE & SPEED Switch Circuit Board

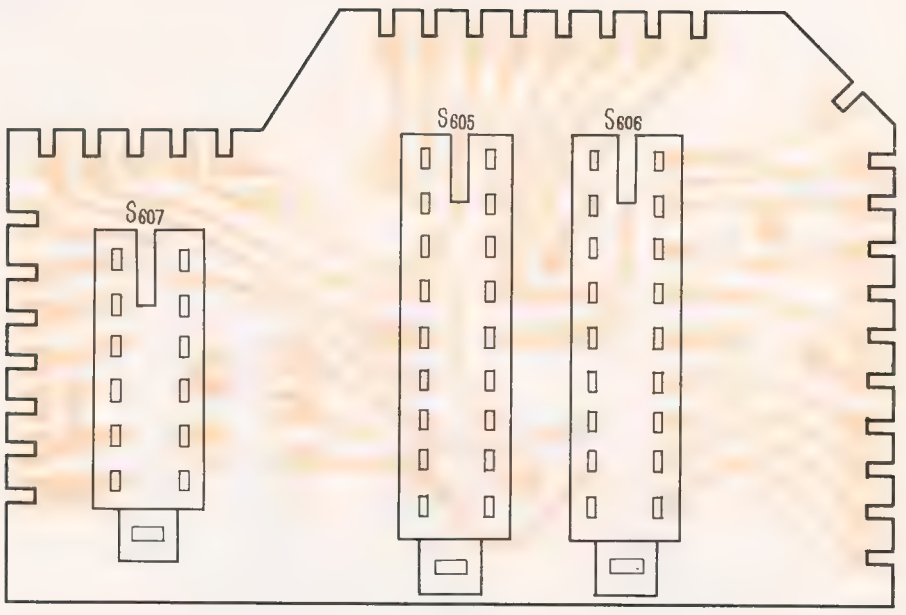
– Conductor Side –



Printed Circuit Board

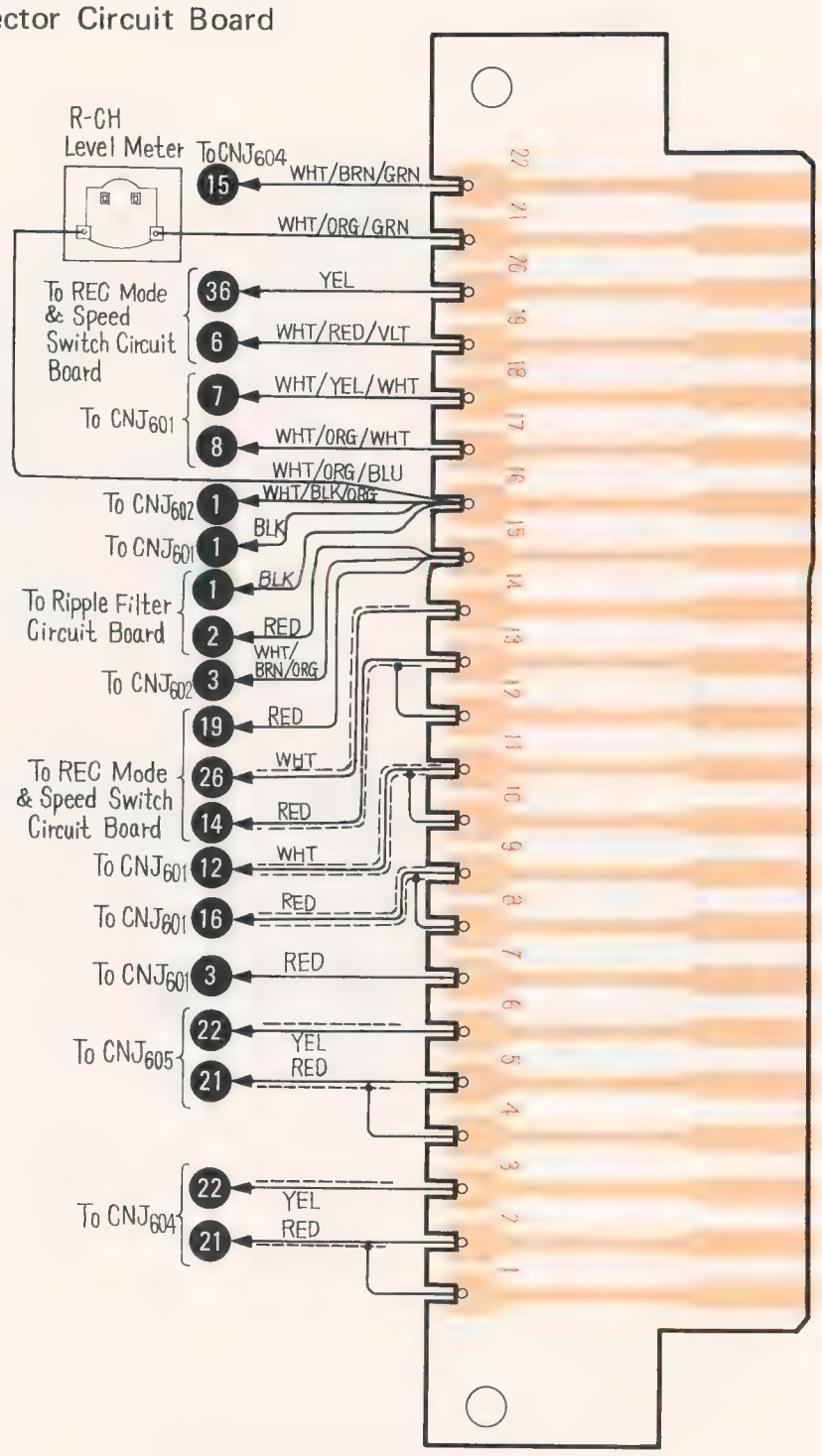
Part No.: 1-539-434-11

– Component Side –



5-17. MOUNTING DIAGRAM

Docking Connector Circuit Board

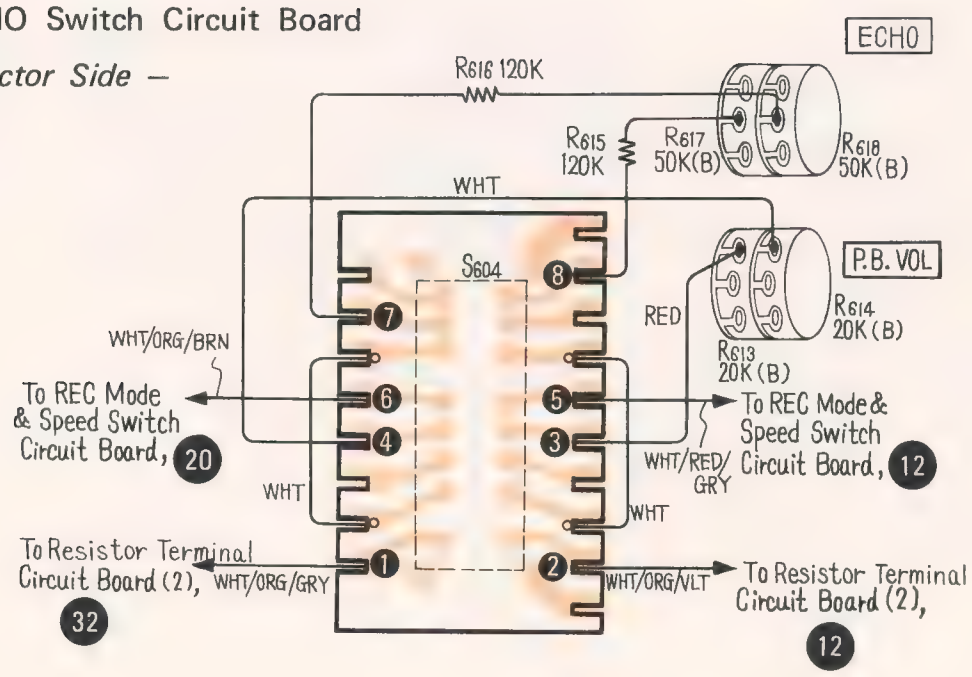


Printed Circuit Board
Part No.: 1-539-437-11

5-18. MOUNTING DIAGRAM

SOS/ECHO Switch Circuit Board

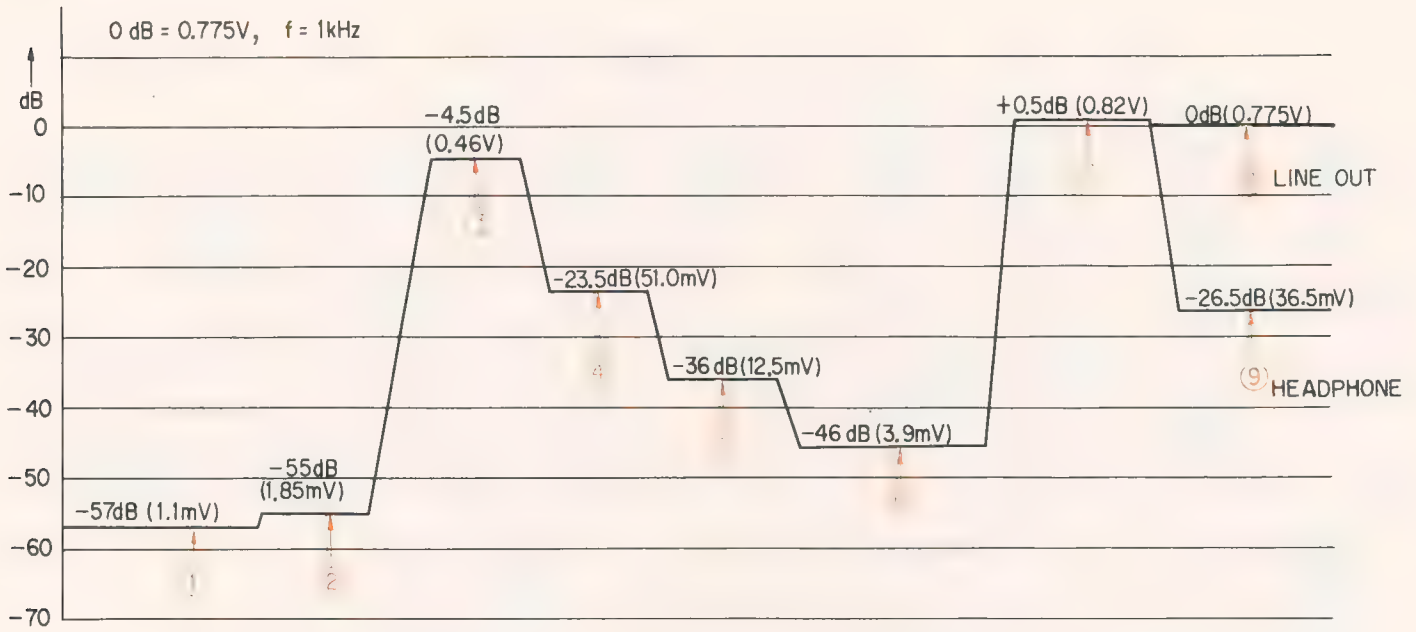
– Conductor Side –



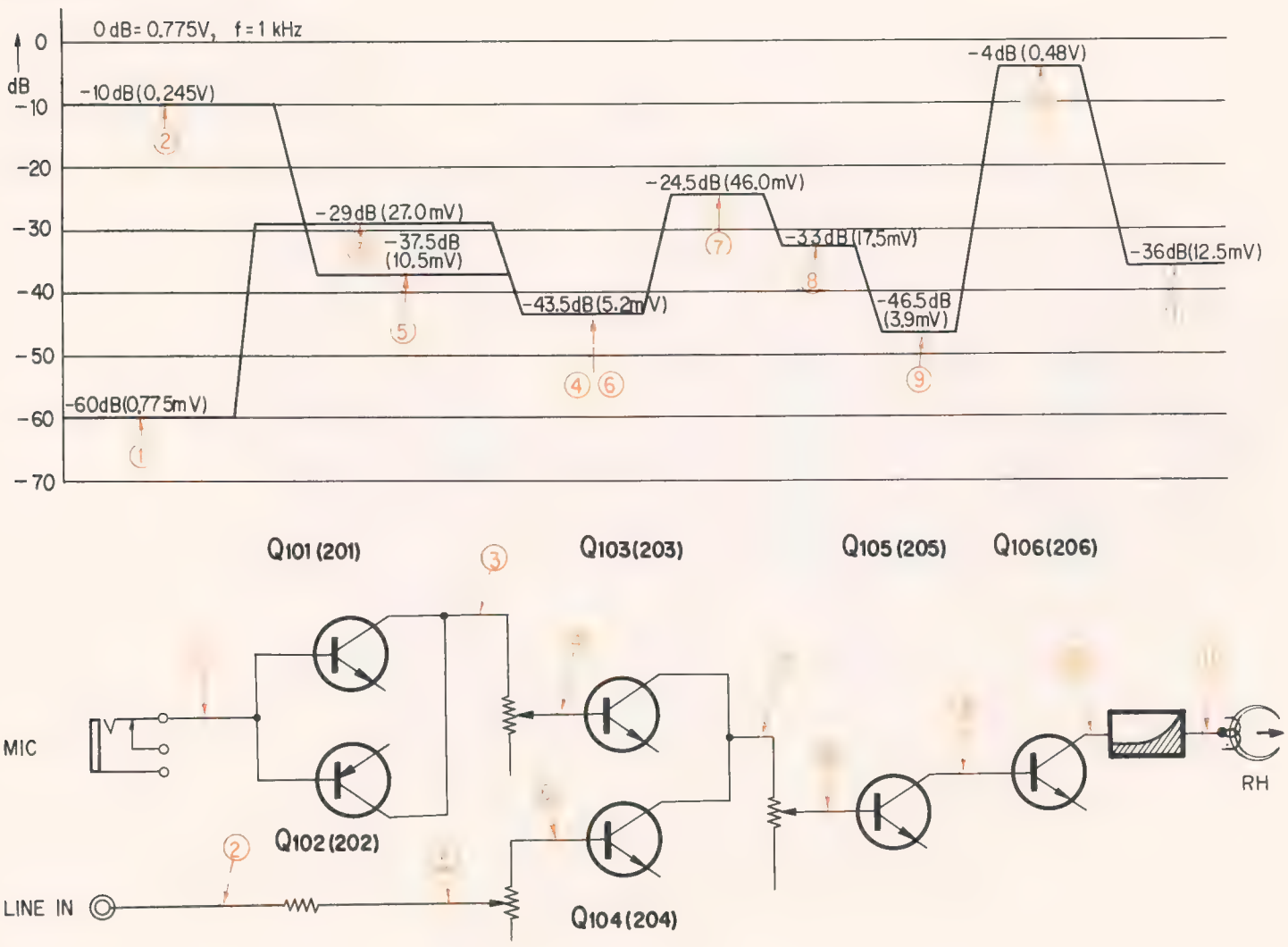
Printed Circuit Board
Part No.: 1-539-443-11

5-19. LEVEL DIAGRAM

Playback



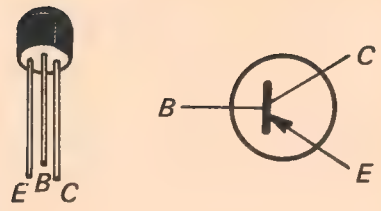
Record



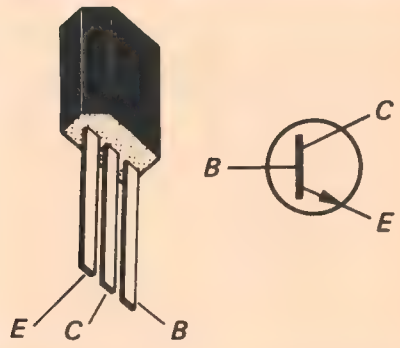
SECTION 6
SEMICONDUCTOR ELECTRODES

Transistor

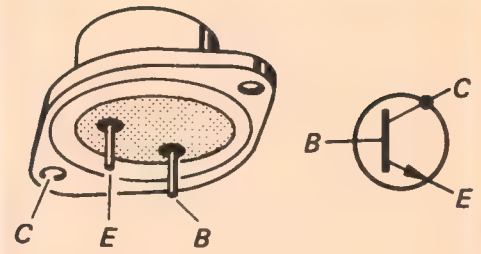
2SA610



2SC631, 2SC633, 2SC634

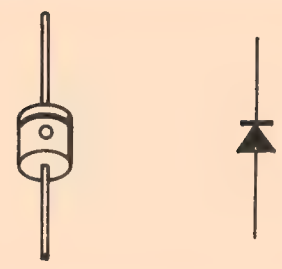


2SD28

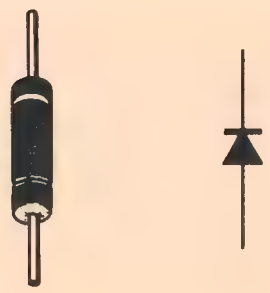


Diode

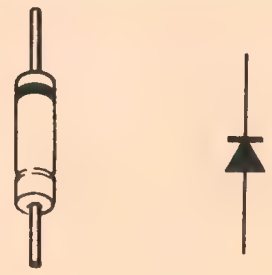
10D2



1S334



1T22



SECTION 7
ELECTRICAL PARTS LIST

★: From Serial No. 10,101 to 11,536

MOUNTED CIRCUIT BOARDS

Ref. No.	Part No.	Description
	X-31408-51-1	system control
★	X-31409-51-4	system control
	X-31408-52	record amp.
	X-31408-53	playback amp.
	X-31408-54	bias osc.
	X-31408-55	record mode & speed switch
	X-31408-56	ripple filter
	X-31409-56	shut-off switch

PRINTED CIRCUIT BOARDS

Ref. No.	Part No.	Description
	1-539-486-11	system control
★	1-539-486-12	system control
	1-539-431-11	record amp.
	1-539-432-11	sub (record amp.)
	1-539-433-11	ripple filter
	1-539-434-11	record mode & speed switch
	1-539-435-11	resistor terminal
	1-539-436-11	head connector
	1-539-437-11	docking
	1-539-438-12	tape shifter switch
	1-539-440-11	bias osc.
	1-539-441-11	sub (bias osc.)
	1-539-443-11	SOS/ECHO switch
	1-539-444-11	playback amp.
	1-539-485-11	shut-off switch

RECORD AMPLIFIER CIRCUIT

SEMICONDUCTORS

Ref. No.	Part No.	Description	
Q101, 201		transistor	2SC631
Q102, 202		transistor	2SA610
Q103, 203		transistor	2SC631
Q104, 204		transistor	2SC634
Q105, 205		transistor	2SC634
Q106, 206		transistor	2SC634
D104, 204		diode	10D2
D105, 205		diode	10D2
D106, 206		– discarded –	
D107, 207		diode	10D2
D108, 208		diode	10D2

COILS

Ref. No.	Part No.	Description	
L101, 201	1-231-069	equalizer	1.81/1.45 mH
L102, 202	1-231-069	equalizer	1.81/1.45 mH

CAPACITORS

Ref. No.	Part No.		
C101, 201	1-121-416	100μF	25V, electrolytic
C102, 202	1-121-398	10μF	25V, electrolytic
C103, 203	1-121-398	10μF	25V, electrolytic
C104, 204	1-105-661-12	0.001μF	50V, mylar
C105, 205	1-121-413	100μF	6.3V, electrolytic
C106, 206	1-121-398	10μF	25V, electrolytic
C107, 207	1-105-661-12	0.001μF	50V, mylar
C108, 208	1-121-398	10μF	25V, electrolytic
C109, 209	1-121-413	100μF	6.3V, electrolytic
C110, 210	1-121-416	100μF	25V, electrolytic
C111, 211	1-121-394	4.7μF	16V, electrolytic
C112, 212	1-105-661-12	0.001μF	50V, mylar
C113, 213	1-105-661-12	0.001μF	50V, mylar
C114, 214	1-121-403	33μF	16V, electrolytic
C115, 215	1-121-394	4.7μF	16V, electrolytic
C116, 216	1-105-661-12	0.001μF	50V, mylar
C117, 217	1-121-403	33μF	16V, electrolytic
C118, 218	1-121-396	4.7μF	50V, electrolytic
C119, 219	1-121-396	4.7μF	50V, electrolytic
C125, 225	1-121-394	4.7μF	16V, electrolytic
C126, 226	1-105-661-12	0.001μF	50V, mylar
C127, 227	1-105-661-12	0.001μF	50V, mylar
C128, 228	1-107-127	680pF	50V, silvered mica
C129, 229	1-121-403	33μF	16V, electrolytic
C130, 230	1-121-407	47μF	6.3V, electrolytic
C131, 231	1-121-398	10μF	25V, electrolytic
C132, 232	1-105-689-12	0.22μF	50V, mylar
C133, 233	1-121-416	100μF	25V, electrolytic
C134, 234	1-105-671-12	0.0068μF	50V, mylar
C152, 252	1-105-677-12	0.022μF	50V, mylar
C153, 253	1-105-681-12	0.047μF	50V, mylar
C154, 254		– discarded –	
C155, 255	1-105-681-12	0.047μF	50V, mylar
C156, 256	1-105-685-12	0.1μF	50V, mylar
C164, 264	1-121-398	10μF	25V, electrolytic
C165, 265	1-121-398	10μF	25V, electrolytic
C168, 268	1-121-398	10μF	25V, electrolytic
C169, 269	1-121-398	10μF	25V, electrolytic
C170, 270	1-121-413	100μF	6.3V, electrolytic

RESISTORS

All resistors are ¼W and carbon type, unless otherwise indicated.

Ref. No.	Part No.	
R101, 201	1-242-689	4,700Ω
R102, 202	1-242-689	4,700Ω
R103, 203	1-242-710	36kΩ
R104, 204	1-242-690	5,100Ω
R105, 205	1-242-704	20kΩ
R106, 206	1-242-659	270Ω
R107, 207	1-242-689	4,700Ω
R108, 208	1-242-690	5,100Ω
R109, 209	1-242-704	20kΩ
R110, 210	1-242-659	270Ω
R111, 211	1-242-671	2,200Ω

Ref. No.	Part No.	Description
R112, 212	1-242-713	47 kΩ
R113, 213	1-242-730	240 kΩ
R114, 214	1-242-653	150 Ω
R115, 215	1-242-677	1,500 Ω
R116, 216	1-242-690	5,100 Ω
R117, 217	1-242-719	82 kΩ
R118, 218	1-242-721	100 kΩ
R119, 219	1-242-645	68 Ω
R120, 220	1-242-689	4,700 Ω
R121, 221	1-242-677	1,500 Ω
R122, 222	1-242-661	330 Ω
R123, 223		– discarded –
R124, 224	1-221-383	10 kΩ (B), semi-fixed
R129, 229		– discarded –
R130, 230	1-242-689	4,700 Ω
R131, 231	1-242-693	6,800 Ω
R132, 232	1-242-713	47 kΩ
R133, 233	1-242-739	560 kΩ
R134, 234	1-242-685	3,300 Ω
R135, 235	1-242-721	100 kΩ
R136, 236	1-242-665	470 Ω
R137, 237	1-242-715	56 kΩ
R138, 238	1-242-665	470 Ω
R139, 239	1-242-677	1,500 Ω
R140, 240	1-242-697	10 kΩ
R141, 241	1-242-649	100 Ω
R142, 242	1-242-671	2,200 Ω
R155, 255	1-242-633	22 Ω
R156, 256	1-242-633	22 Ω
R157, 257		– discarded –
R158, 258	1-242-733	330 kΩ
R159, 259	1-242-733	330 kΩ
R160, 260		– discarded –
R161, 261	1-242-733	330 kΩ
R162, 262	1-242-733	330 kΩ
R163, 263		– discarded –
R164, 264	1-242-697	10 kΩ
R165, 265	1-242-697	10 kΩ
R166, 266		– discarded –
R167, 267	1-242-697	10 kΩ
R168, 268		– discarded –
R169, 269	1-242-697	10 kΩ
R170, 270	1-242-673	1 kΩ
R171, 271	1-242-633	22 Ω
R172, 272	1-242-633	22 Ω
R191, 291	1-242-673	1 kΩ

PLAYBACK AMPLIFIER CIRCUIT

SEMICONDUCTORS

Q301, 401		transistor	2SC631
Q302, 402		transistor	2SC631
Q303, 403		transistor	2SC634
Q304, 404		transistor	2SC634
Q305, 405		transistor	2SC634
Q306, 406		transistor	2SC634
D301, 401		diode	1T22J
D302, 402		diode	1T22J
D305, 405		diode	10D2

TRANSFORMER

T301, 401	1-427-270	headphone

CAPACITORS

C301, 401	1-121-410	47 μF	25 V, electrolytic
C302, 402	1-107-123	47 pF	50 V, silvered mica
C303, 403	1-131-137	3.3 μF	16 V, tantalum
C304, 404	1-105-661-12	0.001 μF	50 V, mylar
C305, 405	1-121-403	33 μF	16 V, electrolytic
C306, 406	1-121-397	10 μF	16 V, electrolytic
C307, 407	1-121-398	10 μF	25 V, electrolytic
C308, 408	1-121-416	100 μF	25 V, electrolytic
C309, 409	1-121-391	1 μF	50 V, electrolytic
C310, 410	1-107-131	100 pF	50 V, silvered mica
C311, 411	1-105-661-12	0.001 μF	50 V, mylar
C312, 412	1-121-409	47 μF	16 V, electrolytic
C313, 413	1-107-125	56 pF	50 V, silvered mica
C314, 414	1-105-667-12	0.0033 μF	50 V, mylar
C315, 415	1-121-416	100 μF	25 V, electrolytic
C316, 416	1-121-424	470 μF	6.3 V, electrolytic
C317, 417	1-121-398	10 μF	25 V, electrolytic
C318, 418	1-105-671-12	0.0068 μF	50 V, mylar
C319, 419	1-121-391	1 μF	50 V. electrolytic
C320, 420	1-121-396	4.7 μF	25 V, electrolytic
C321, 421	1-121-398	10 μF	25 V, electrolytic
C322, 422	1-121-394	4.7 μF	16 V, electrolytic
C323, 423	1-121-391	1 μF	50 V, electrolytic
C324, 424		– discarded –	
C325, 425	1-105-665-12	0.0022 μF	50 V, mylar
C326, 426	1-121-404	33 μF	25 V, electrolytic
C327, 427	1-105-677-12	0.022 μF	50 V, mylar
C328, 428		– discarded –	
C329, 429	1-121-398	10 μF	25 V, electrolytic
C330, 430	1-121-398	10 μF	25 V, electrolytic
C334, 434	1-121-410	47 μF	25 V, electrolytic
C338, 438	1-121-410	47 μF	25 V, electrolytic

RESISTORS

All resistors are ¼W and carbon type, unless otherwise indicated.

R301, 401	1-242-725	150 kΩ
R302, 402	1-242-739	560 kΩ
R303, 403	1-242-649	100 Ω
R304, 404	1-242-721	100 kΩ

Ref. No.	Part No.	Description
R305, 405	1-242-710	36 kΩ
R306, 406	1-242-705	22 kΩ
R307, 407	1-242-692	6,200 Ω
R308, 408	1-242-692	6,200 Ω
R309, 409	1-242-697	10 kΩ
R312, 412	1-242-681	2,200 Ω
R313, 413	1-242-685	3,300 Ω
R314, 414	1-242-681	2,200 Ω
R315, 415	1-242-705	22 kΩ
R316, 416	1-242-665	470 Ω
R317, 417	1-242-677	1,500 Ω
R318, 418	1-242-710	36 kΩ
R319, 419	1-242-707	27 kΩ
R320, 420	1-242-662	360 Ω
R321, 421	1-242-677	1,500 Ω
R322, 422	1-242-657	220 Ω
R323, 423	1-242-668	620 Ω
R324, 424	1-242-697	10 kΩ
R325, 425	1-242-697	10 kΩ
R326, 426	1-242-725	150 kΩ
R327, 427	1-242-731	270 kΩ
R328, 428	1-242-681	2,200 Ω
R329, 429	1-221-311	5 kΩ (B), semi-fixed
R330, 430	1-242-697	10 kΩ
R331, 431	1-242-705	22 kΩ
R332, 432	1-242-705	22 kΩ
R342, 442	1-221-311	5 kΩ (B), semi-fixed
R343, 443	1-242-673	1 kΩ
R344, 444	1-221-311	5 kΩ (B), semi-fixed
R345, 445	1-242-673	1 kΩ
R351, 451	1-242-681	2,200 Ω
R352, 452	1-242-725	150 kΩ
R358, 458	1-242-733	330 kΩ
R359, 459	1-242-701	15 kΩ
R363, 463	1-242-701	15 kΩ
R365, 465	1-242-697	10 kΩ
R367, 467	1-242-697	10 kΩ
R380, 480	1-242-709	33 kΩ
R381, 481	1-242-721	100 kΩ
R382, 482	1-242-681	2,200 Ω

BIAS OSCILLATOR CIRCUIT

SEMICONDUCTORS

Q501	transistor	2SC634
Q502	transistor	2SC634
Q503	transistor	2SC634
D501	diode	10D2

COILS

L501	1-231-069	equalizer, 1.8 mH
L502	1-231-069	equalizer, 1.8 mH
L503	1-409-038	dummy, 1.0 mH
L504	1-409-038	dummy, 1.0 mH
L505	1-407-198	micro inductor, 2.2 mH
L506	1-407-198	micro inductor, 2.2 mH

TRANSFORMER

T501	1-433-143	bias oscillator

CAPACITORS

C501	1-107-188	620 pF	500 V, silvered mica
C502	1-107-188	620 pF	500 V, silvered mica
C503	1-121-410	47 μF	25 V, electrolytic
C504	1-121-416	100 μF	25 V, electrolytic
C505	1-121-416	100 μF	25 V, electrolytic
C506	1-121-398	10 μF	25 V, electrolytic
C507	1-107-188	620 pF	500 V, silvered mica
C508	1-107-188	620 pF	500 V, silvered mica
C509	1-105-663-12	0.0015 μF	50 V, mylar
C510	1-109-504	5,100 pF	500 V, dipped mica
C511	1-141-076	30～200 pF	, trimmer
C512	1-141-076	30～200 pF	, trimmer
C513	1-107-177	220 pF	25 V, silvered mica
C514	1-107-177	220 pF	25 V, silvered mica

RESISTORS

All resistors are ¼W and carbon type, unless otherwise indicated.

R501	1-242-649	100 Ω
R502	1-242-671	820 Ω
R503	1-242-657	220 Ω
R504	1-242-625	10 Ω
R505	1-242-625	10 Ω
R506	1-242-725	150 kΩ
R507	1-242-725	150 kΩ
R508	1-242-625	10 Ω
R509	1-242-667	560 Ω

RELAY

RY501	1-515-127	32.8 mA

AMPLIFIER CHASSIS CIRCUIT

SEMICONDUCTORS

D601	diode	10D2

CAPACITORS

C601	1-105-689-12	0.22 μF	50 V, mylar
C602	1-105-689-12	0.22 μF	50 V, mylar
C603	1-109-501	910 pF	500 V, dipped mica

Ref. No.	Part No.	Description
		RESISTORS
		All resistors are ¼W and carbon type, unless otherwise indicated.
R601	1-242-669	680Ω
R602	1-242-669	680Ω
R603	1-242-721	100kΩ
R604	1-242-729	220kΩ
R605	1-242-721	100kΩ
R606	1-242-729	220kΩ
R607	1-222-314	20kΩ (B), variable (L-CH MIC)
R608	1-222-314	20kΩ (B), variable (L-CH LINE)
R609	1-222-314	20kΩ (B), variable (R-CH MIC)
R610	1-222-314	20kΩ (B), variable (R-CH LINE)
R611	1-244-624	9,100Ω
R612	1-244-624	9,100Ω
R613	1-222-314	20kΩ (B), variable (L-CH PB)
R614	1-222-314	20kΩ (B), variable (R-CH PB)
R615	1-244-723	120kΩ
R616	1-244-723	120kΩ
R617	1-222-313	50kΩ (B), variable (L-CH SOS/ECHO)
R618	1-222-313	50kΩ (B), variable (R-CH SOS/ECHO)
R619	1-242-673	1kΩ
R620	1-242-673	1kΩ
R621	1-242-673	1kΩ
		JACKS
J601	1-507-142	phono (2P), L-CH LINE OUT
J602	1-507-142	phono (2P), R-CH LINE OUT
J603	1-507-281	miniature, L-CH MIC (side)
J604	1-507-281	miniature, R-CH MIC (side)
J605	1-507-281	miniature, L-CH MIC (upper)
J606	1-507-281	miniature, R-CH MIC (upper)
J607	1-507-142	phono (2P), L-CH LINE OUT
J608	1-507-142	phono (2P), R-CH LINE OUT
J609	1-507-282	binaural, HEADPHONE
		SWITCHES
S601	1-514-324	slide, TAPE SELECTOR
S602	1-514-692	lever, MONITOR (L-CH)
S603	1-514-692	lever, MONITOR (R-CH)
S604	1-514-693	lever, 3-position, SOS/OFF/ECHO
S605	1-514-631	2-key, REC MODE (L-CH)
S606	1-514-631	2-key, REC MODE (R-CH)
S607	1-514-680	1-key, TAPE SPEED
		CONNECTORS
CNJ601	1-507-300	22P, BIAS
CNJ602	1-507-300	22P, L-CH RECORD AMP
CNJ603	1-507-300	22P, R-CH RECORD AMP
CNJ604	1-507-300	22P, L-CH PLAYBACK AMP
CNJ605	1-507-300	22P, R-CH PLAYBACK AMP
CNJ606	1-509-371	3P, PLAYBACK EQUALIZER
CNP601	1-539-437-11	22P, AMP CONNECTOR

Ref. No.	Part No.	Description
		LAMPS
PL601		– built in level meter –
PL602		– built in level meter –
PL603	1-518-093-21	record 100mA
PL604	1-518-093-21	record 100mA
		METERS
ME601	1-524-067	VU
ME602	1-524-067	VU
		MISCELLANEOUS
	1-509-372	terminal, pin

SYSTEM CONTROL CIRCUIT

		SEMICONDUCTORS	
Q701		transistor	2SC634
Q702		transistor	2SC634
Q703		transistor	2SD28
Q704		transistor	2SC634
Q705		transistor	2SC634
Q706		transistor	2SC634
Q707		transistor	2SD28
Q708～712		transistor	2SC634
D701～714		diode	10D2
D716		diode	10D2
D717		diode	10D2
D720～730		diode	10D2
★ D731, 732		diode	10D2
DZ701～703		diode, zener	1S334
		CAPACITORS	
C701	1-121-388	1,000μF	35V, electrolytic
C702	1-121-410	47μF	25V, electrolytic
C703	1-121-733	470μF	25V, electrolytic
C704	1-121-361	470μF	35V, electrolytic
C705	1-121-410	47μF	25V, electrolytic
C706	1-121-388	1,000μF	35V, electrolytic
C707		– discarded –	
★ C707	1-121-422	220μF	25V, electrolytic
C708		– discarded –	
★ C708	1-105-661-12	0.001μF	50V, mylar
C709	1-105-689-11	0.22μF	50V, mylar
C710	1-121-410	47μF	25V, electrolytic
C711	1-121-422	220μF	25V, electrolytic
C712	1-121-422	220μF	25V, electrolytic
C713	1-121-422	220μF	25V, electrolytic
C714	1-121-398	10μF	25V, electrolytic
C715	1-121-380	22μF	25V, electrolytic
C716		– discarded –	
★ C716	1-121-392	3.3μF	25V, electrolytic

Ref. No.	Part No.	Description	
		RESISTORS	
		All resistors are ¼W and carbon type, unless otherwise indicated.	
R701	1-244-817	4.7 Ω	½W
R702	1-242-689	4,700 Ω	
R703	1-242-665	470 Ω	
R704	1-242-677	1,500 Ω	
R705	1-242-685	3,300 Ω	
R706	1-242-682	2,400 Ω	
R707	1-242-709	33 kΩ	
R708	1-242-665	470 Ω	
R709	1-242-677	1,500 Ω	
R710	1-242-690	5,100 Ω	
R711	1-242-687	3,900 Ω	
R712		– discarded –	
★ R712	1-242-681	2,200 Ω	
R713		– discarded –	
★ R713	1-242-705	22 kΩ	
R714	1-242-691	5,600 Ω	
R715	1-244-885	3,300 Ω	
R716	1-242-705	22 kΩ	
R717	1-242-665	470 Ω	
R718	1-242-709	33 kΩ	
R719	1-242-705	22 kΩ	
R720	1-242-673	1 kΩ	
R721	1-242-709	33 kΩ	
R722	1-242-709	33 kΩ	
R723	1-242-707	27 kΩ	
R724	1-242-713	47 kΩ	
R725	1-242-713	47 kΩ	
R726	1-242-705	22 kΩ	
R727	1-242-697	10 kΩ	
R728	1-242-697	10 kΩ	
R729	1-242-683	2,700 Ω	
R730	1-242-701	15 kΩ	
R731	1-242-705	22 kΩ	
R732	1-242-685	3,300 Ω	
R733	1-242-699	12 kΩ	
R734	1-242-705	22 kΩ	
R735	1-242-677	1,500 Ω	
R736	1-242-697	10 kΩ	
R737	1-242-705	22 kΩ	
R738	1-207-273	5.1 Ω	1.5W, wire wound
R739	1-207-273	5.1 Ω	1.5W, wire wound
R740	1-207-273	5.1 Ω	1.5W, wire wound
R741	1-242-705	22 kΩ	
R742	1-242-709	33 kΩ	
R743	1-242-690	5,100 Ω	
R744		– discarded –	
★ R744	1-242-657	220 Ω	
		ENCAPSULATED COMPONENTS C-R	
CP701	1-101-534	0.1 μF+120 Ω	500V
CP702	1-101-534	0.1 μF+120 Ω	500V
CP703	1-101-534	0.1 μF+120 Ω	500V
CP704	1-101-534	0.1 μF+120 Ω	500V
CP705	1-101-528	0.1 μF+120 Ω	250V
		RELAYS	
RY701	1-515-127	650 Ω	24V
RY702	1-515-127	650 Ω	24V
RY703	1-515-127	650 Ω	24V
RY704	1-515-127	650 Ω	24V

MECHANICAL CHASSIS CIRCUIT

		SEMICONDUCTORS	
Q802		transistor	2SD28
Q803		transistor	2SD28
Q804		transistor	2SD28
Q805		transistor	2SD28
D801		diode	10D2
D802		diode	10D2
		TRANSFORMER	
T801	1-441-579	power	
		CAPACITORS	
C801	1-117-040	2μF+0.5μF	300V, MP
C802	1-117-082	4μF	300V, MP
C803	1-117-054	0.47μF	350V, MP
C804	1-117-054	0.47μF	350V, MP
C805	1-117-082	4μF	300V, MP
C806	1-105-681-12	0.047μF	50V, mylar
		RESISTORS	
R801	1-205-506	1 kΩ	30W, wire wound
R802	1-205-503	68 Ω	40W, wire wound
R803	1-205-503	68 Ω	40W, wire wound
		CONNECTORS	
CNJ801	1-509-062	power supply; AC INPUT	
CNJ802	1-509-341	power supply; AC OUTLET	
CNJ803	1-507-300	22P; AMP (for CNP601)	
CNJ804	1-507-301	18P, heads	
CNJ805	1-507-255	11P; REMOTE CONTROL	
CNP801	1-506-180	11P; REMOTE CONTROL dummy	
CNP802	1-539-436-11	head connector	
CNP803	1-508-400	3P	
		SWITCHES	
S801	1-514-531-22	seesaw; POWER	
S802	1-514-057	micro; REC	
S803	1-514-057	micro; REW	
S804	1-514-057	micro; STOP	

Ref. No.	Part No.	Description
S805	1-514-057	micro; FWD
S806	1-514-057	micro; FF
S807	1-514-680	key; TAPE SHIFTER
S808	1-514-530	micro; SHUT-OFF

MOTORS

M801	8-831-634-13	capstan, synchronous (HC-634D5)
M802	8-836-624-07	reel, induction (UC-624K)
M803	8-836-624-07	reel, induction (UC-624K)

SOLENOIDS

PM801	1-454-052	pinch roller
PM802	1-454-053	tape shifter
PM803	1-454-053	brake

LAMPS

PL801	1-518-053	FF	0.04A
PL802	1-518-053	REW	0.04A
PL803	1-518-053	PLAY	0.04A
PL804	1-518-053	REC	0.04A

SOCKETS

PLB801	1-517-018	lamp
PLB802	1-517-018	lamp
PLB803	1-517-018	lamp
PLB804	1-517-018	lamp

ENCAPSULATED COMPONENTS C-R

CP801	1-101-528	0.1μF+120Ω	250V
CP802	1-101-534	0.1μF+120Ω	500V
CP803	1-101-528	0.1μF + 120Ω	250V

MISCELLANEOUS

FB801	1-533-048	holder, fuse
	1-536-213	terminal strip, 5P

Ref. No.	Part No.	Description

HEAD UNIT

HEADS

RECH	8-824-629-20	record (RP102-2902)
PBH	8-829-142-20	playback (PP102-4202)
EH	8-826-629-25	erase (EF18-2902A) (for 4-track)
RECH	8-824-122-20	(RP30-2202)
PBH	8-822-528-21	(PP77-2802A)
EH	8-828-522-20	(EF85-2202) (for 2-track)

HEAD ASSEMBLY

	H17-4S	4-track
	H17-2S	2-track

CONNECTOR

CNJ804	1-507-301	18P, heads

SHUT-OFF SWITCH CIRCUIT

SEMICONDUCTOR

Q801		transistor 2SD28

RESISTORS

R804	1-206-161	2,200Ω	3W, wire wound
R805	1-242-709	33kΩ	¼W, carbon

RIPPLE FILTER CIRCUIT

(Up to Serial No. 10,100)

SEMICONDUCTOR

Q901		transistor 2SC634

CAPACITOR

C901	1-121-422	220μF	25V, electrolytic

RESISTORS

R901	1-242-681	2,200Ω	¼W, carbon
R902	1-242-705	22kΩ	¼W, carbon
R903	1-242-657	220Ω	¼W, carbon

When ordering replacement parts, you should use PART NUMBER listed on the Parts Lists or shown in the Exploded View.
The symbol number should not be used for ordering purposes.

SECTION 8
HARDWARES

Part No.	*Description*
	SCREWS
7-621-852-39	⊕ K 2.7 x 10, wood; Cr
7-621-852-30	⊕ K 2.7 x 10, wood; Ni
7-621-842-26	⊕ R 2.7 x 8, wood
	⊕ K 3.8 x 12, wood
7-621-569-02	⊕ K 4 x 16
7-621-569-22	⊕ K 4 x 20
7-621-569-52	⊕ K 4 x 26
7-682-167-00	⊕ P 4 x 24
7-682-225-02	⊕ K 2 x 5
7-682-226-02	⊕ K 2 x 6
7-682-247-02	⊕ K 3 x 6
7-682-248-02	⊕ K 3 x 8
7-682-250-02	⊕ K 3 x 12
7-682-253-02	⊕ K 3 x 20
7-682-260-02	⊕ K 4 x 6
7-682-261-02	⊕ K 4 x 8
7-682-624-02	⊕ PS 2 x 4
7-682-625-02	⊕ PS 2 x 5
7-682-647-02	⊕ PS 3 x 6
7-682-648-02	⊕ PS 3 x 8
7-682-649-02	⊕ PS 3 x 10
7-682-650-02	⊕ PS 3 x 12
7-682-651-02	⊕ PS 3 x 14
7-682-659-02	⊕ PS 4 x 5
7-682-661-02	⊕ PS 4 x 8
7-682-662-02	⊕ PS 4 x 10
7-682-663-02	⊕ PS 4 x 12
7-621-259-48	⊕ P 2.6 x 6
7-621-261-52	⊕ P 3 x 8
7-682-126-02	⊕ P 2 x 6
7-682-150-02	⊕ P 3 x 12
7-682-153-02	⊕ P 3 x 20

Part No.	*Description*
7-682-163-02	⊕ P 4 x 12
7-682-248-04	⊕ K 3 x 8
7-682-526-02	⊕ B 2 x 6
7-621-730-31	⊕ B 2.6 x 4
7-682-547-04	⊕ B 3 x 6
7-682-548-05	⊕ B 3 x 8
7-683-238-31	3 x 4, set screw; w/hexagon socket
7-682-247-31	4 x 6, set screw; w/hexagon socket
	2 x 3, set screw; w/hexagon socket
	2 x 4, set screw; w/hexagon socket
	NUTS
7-622-107-04	2.6ϕ
7-684-013-02	3ϕ
7-684-014-02	4ϕ
	SPRING WASHER
7-623-207-21	2.6ϕ
7-623-208-21	3ϕ
7-623-210-21	4ϕ
	PLAIN WASHER
7-623-105-14	2ϕ (middle)
7-623-108-14	3ϕ (middle)
7-623-110-14	4ϕ (middle)
	LOCK WASHER
7-623-408-01	3ϕ

— Hardware Nomenclature —

P – Pan Head Screw . . . . . ⊕

PS – Pan Head Screw with Spring Washer . . . . . ⊕

K – Flat Countersunk Head Screw . . . ⊕

B – Binding Head Screw . . . . . ⊕

RK – Oval Countersunk Head Screw . . ⊕

T – Truss Head Screw . . . . . ⊕

R – Round Head Screw . . . . . ⊕

F – Flat Fillister Head Screw . . . . . ⊖

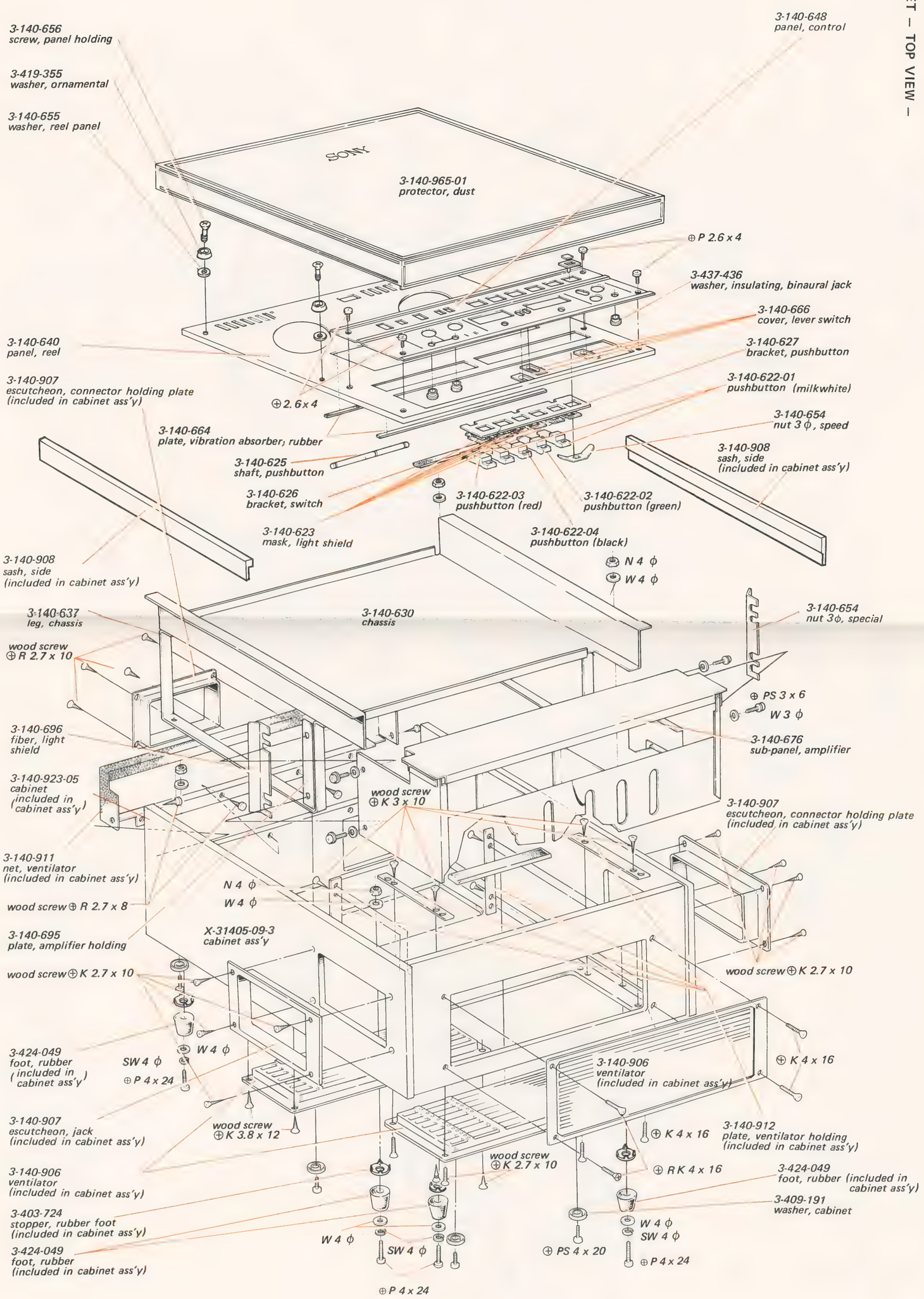
SC – Set Screw . . . . . ⊖

E – Retaining Ring (E Washer) . . . . .

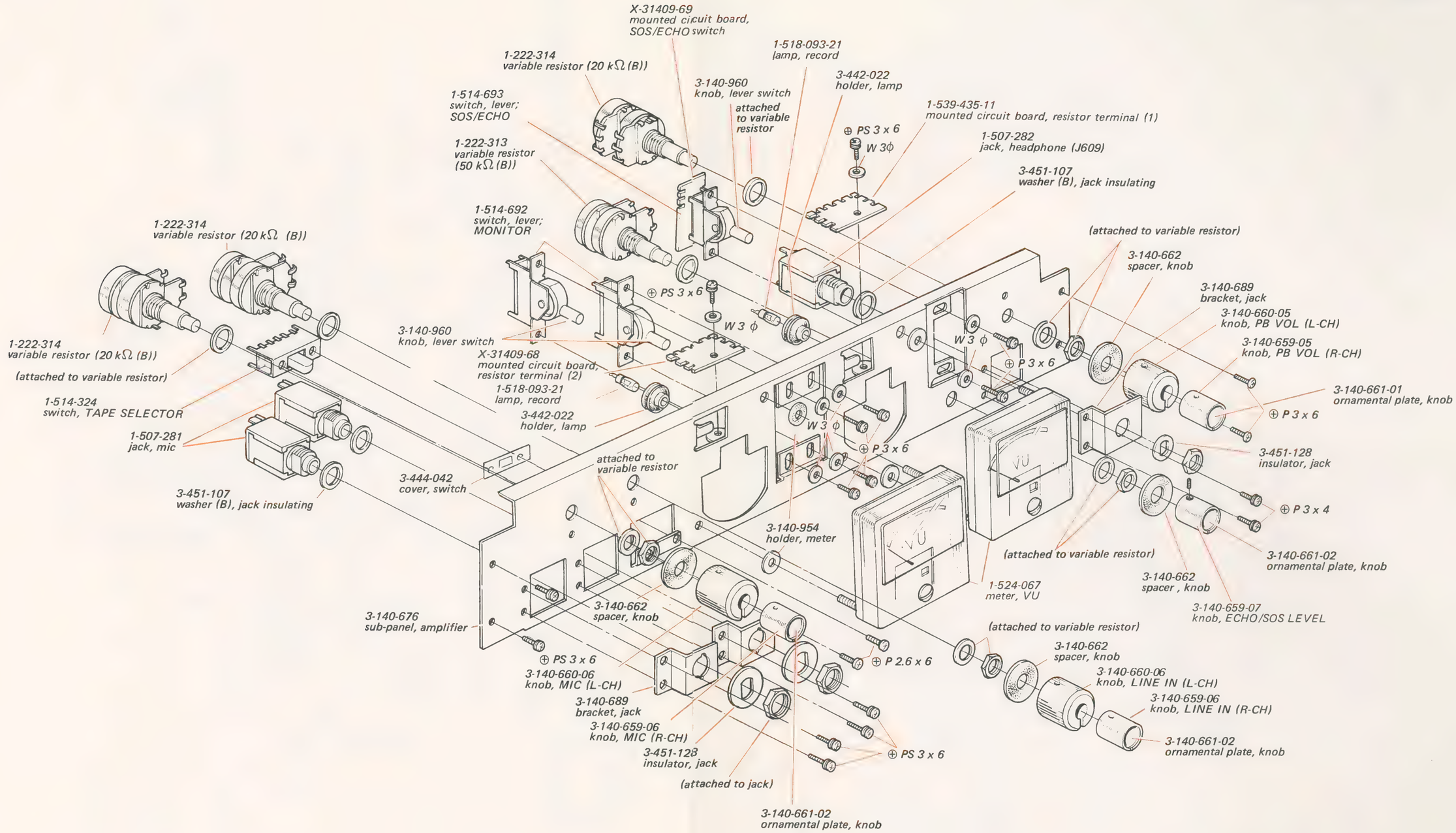
W – Washer
SW – Spring Washer
LW – Lock Washer
N – Nut

– Example –

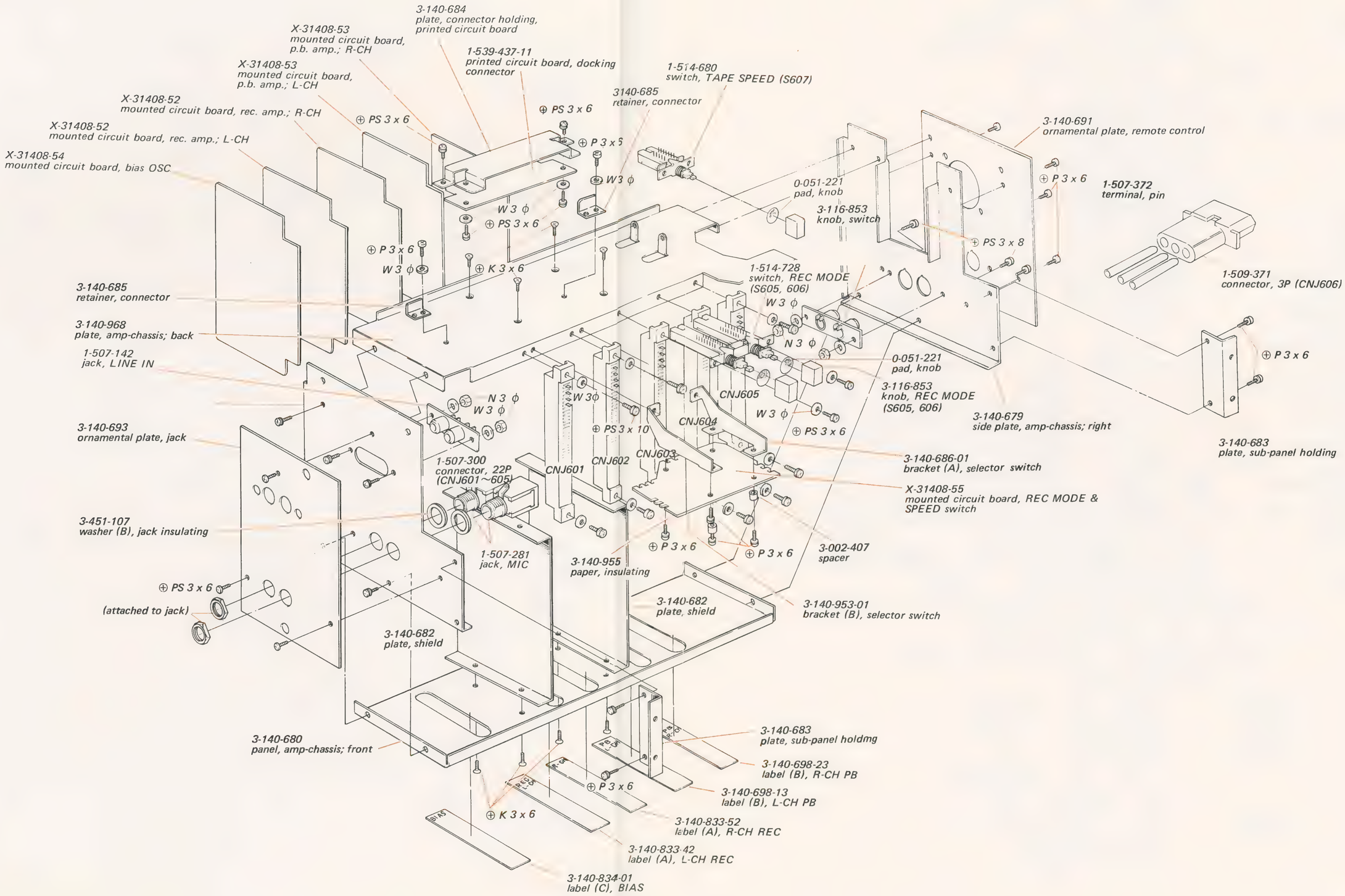
⊕ P 3x10
- P: Type of Head
- 3: Diameter in mm (D)
- 10: Length in mm (L)
- ⊕: Type of Slot


3-140-656
screw, panel holding
3-419-355
washer, ornamental
3-140-655
washer, reel panel
3-140-648
panel, control
SONY
3-140-965-01
protector, dust
⊕P 2.6 x 4
3-437-436
washer, insulating, binaural jack
3-140-666
cover, lever switch
3-140-627
bracket, pushbutton
3-140-640
panel, reel
3-140-907
escutcheon, connector holding plate
(included in cabinet ass'y)
⊕2.6 x 4
3-140-622-01
pushbutton (milkwhite)
3-140-654
nut 3 ϕ, speed
3-140-664
plate, vibration absorber, rubber
3-140-908
sash, side
(included in cabinet ass'y)
3-140-625
shaft, pushbutton
3-140-626
bracket, switch
3-140-622-03
pushbutton (red)
3-140-622-02
pushbutton (green)
3-140-623
mask, light shield
3-140-622-04
pushbutton (black)
N 4 ϕ
W 4 ϕ
3-140-908
sash, side
(included in cabinet ass'y)
3-140-637
leg, chassis
3-140-630
chassis
3-140-654
nut 3ϕ, special
wood screw
⊕R 2.7 x 10
⊕PS 3 x 6
W 3 ϕ
3-140-696
fiber, light
shield
3-140-676
sub-panel, amplifier
3-140-923-05
cabinet
(included in
cabinet ass'y)
wood screw
⊕K 3 x 10
3-140-907
escutcheon, connector holding plate
(included in cabinet ass'y)
3-140-911
net, ventilator
(included in cabinet ass'y)
N 4 ϕ
W 4 ϕ
wood screw ⊕R 2.7 x 8
X-31405-09-3
cabinet ass'y
3-140-695
plate, amplifier holding
wood screw ⊕K 2.7 x 10
wood screw ⊕K 2.7 x 10
3-424-049
foot, rubber
(included in
cabinet ass'y)
SW 4 ϕ
W 4 ϕ
⊕P 4 x 24
3-140-906
ventilator
(included in cabinet ass'y)
⊕K 4 x 16
3-140-907
escutcheon, jack
(included in cabinet ass'y)
wood screw
⊕K 3.8 x 12
⊕K 4 x 16
3-140-912
plate, ventilator holding
(included in cabinet ass'y)
wood screw
⊕K 2.7 x 10
⊕RK 4 x 16
3-424-049
foot, rubber (included in
cabinet ass'y)
3-140-906
ventilator
(included in cabinet ass'y)
3-409-191
washer, cabinet
3-403-724
stopper, rubber foot
(included in cabinet ass'y)
W 4 ϕ
SW 4 ϕ
W 4 ϕ
SW 4 ϕ
3-424-049
foot, rubber
(included in cabinet ass'y)
⊕PS 4 x 20
⊕P 4 x 24
⊕P 4 x 24

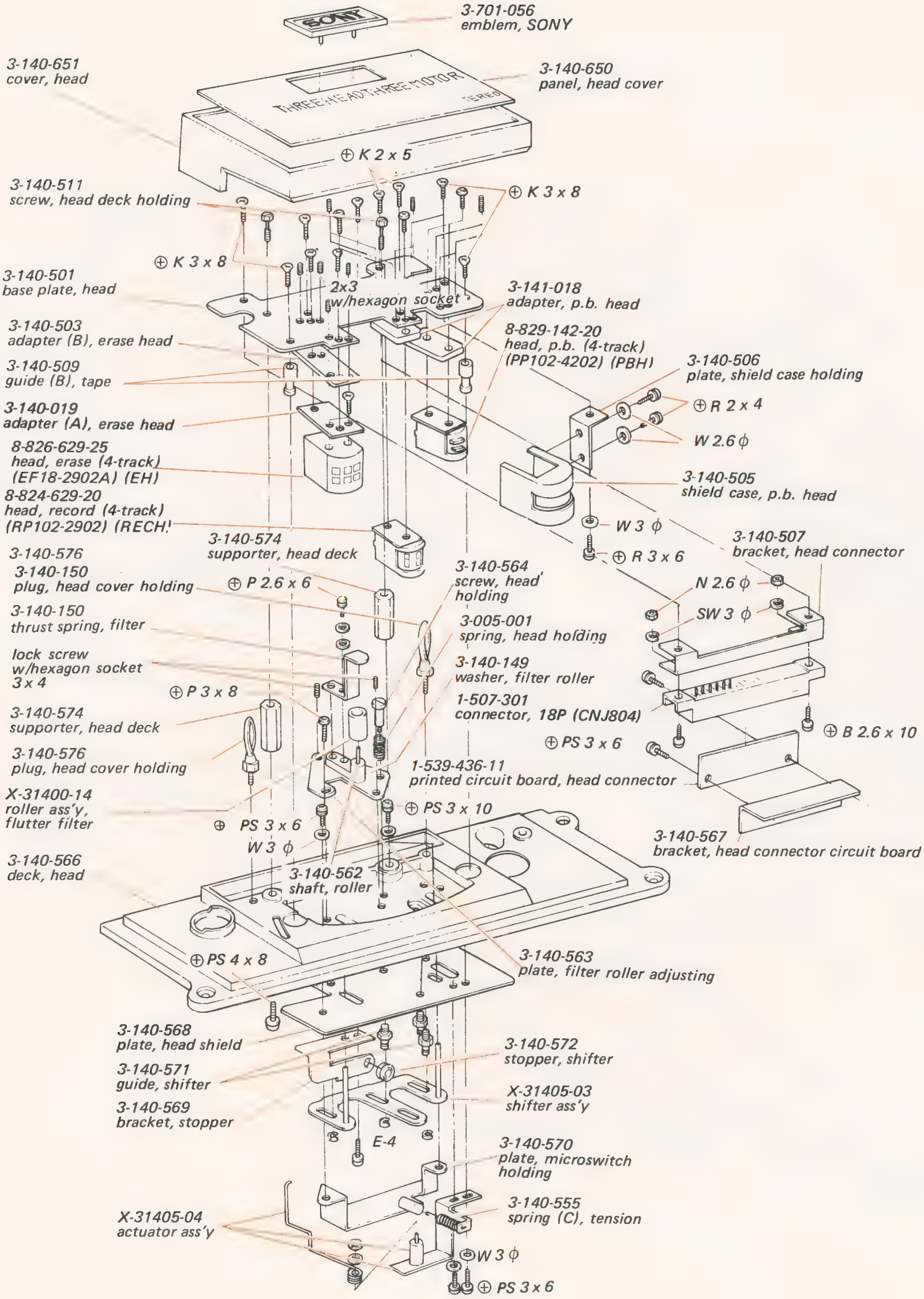
9-2. AMP SUB-PANEL — TOP VIEW —



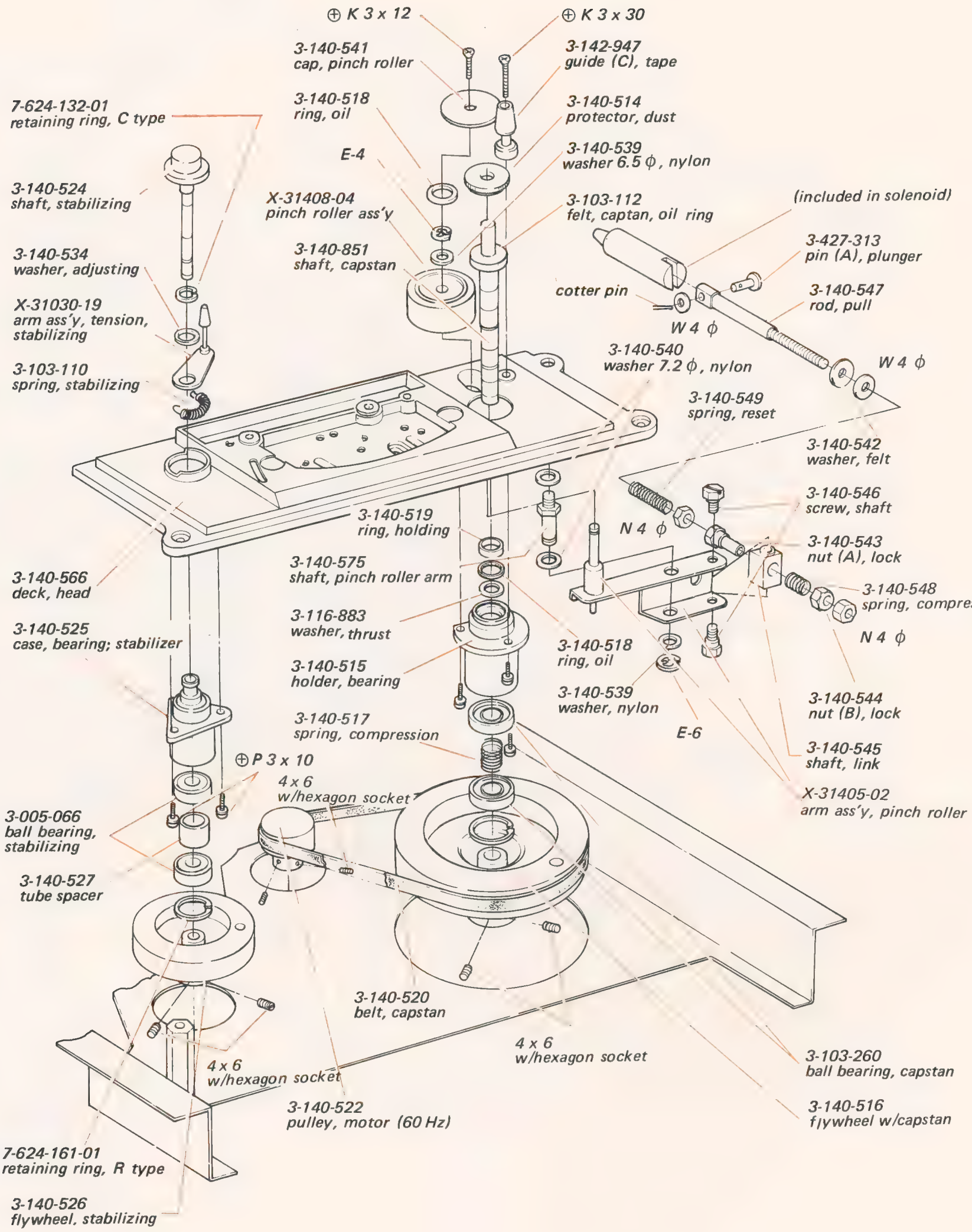
9-3. AMP CHASSIS PANEL – TOP VIEW –

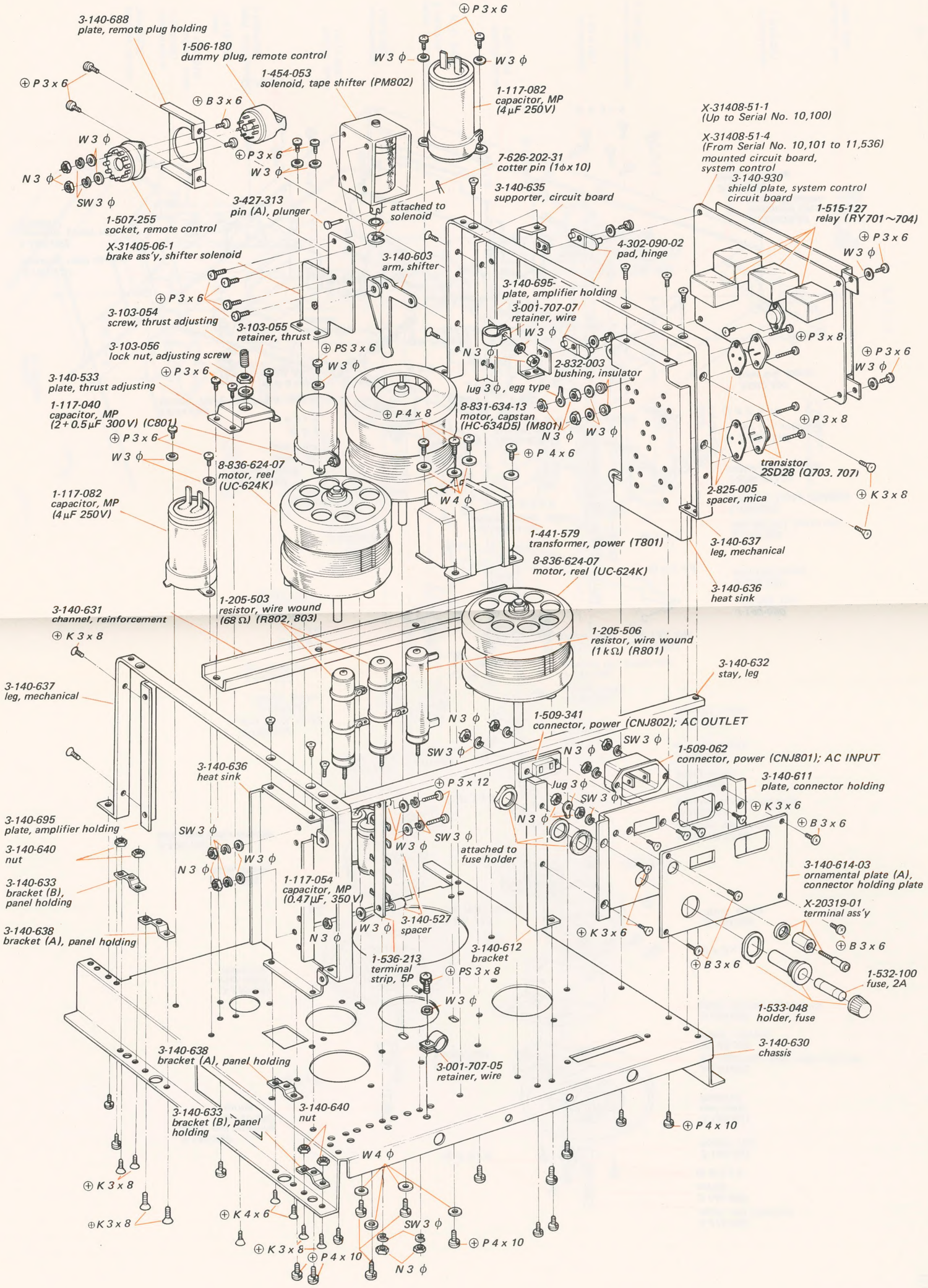


9-4. HEAD DECK – TOP VIEW –

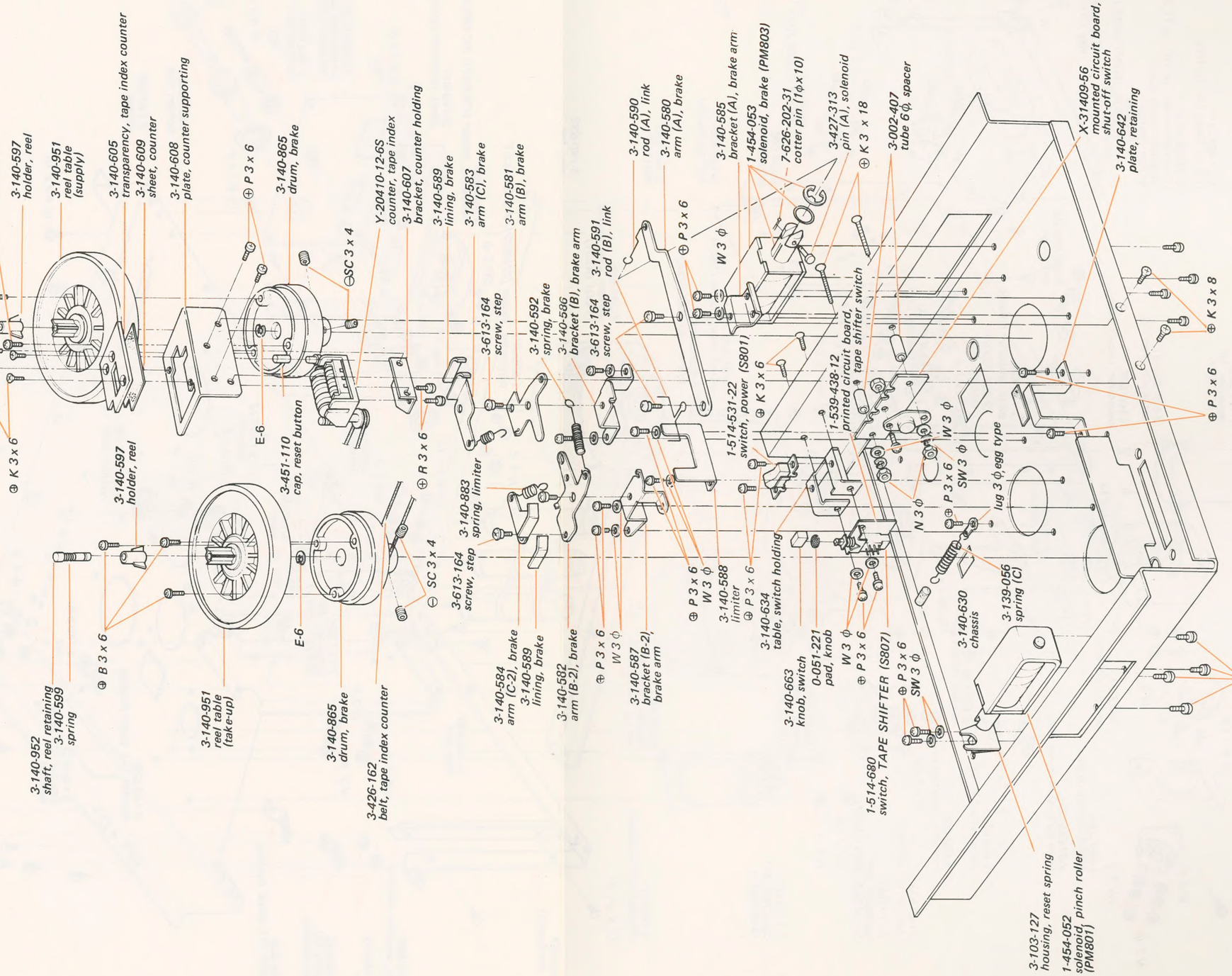


9-5. FLYWHEEL – TOP VIEW –

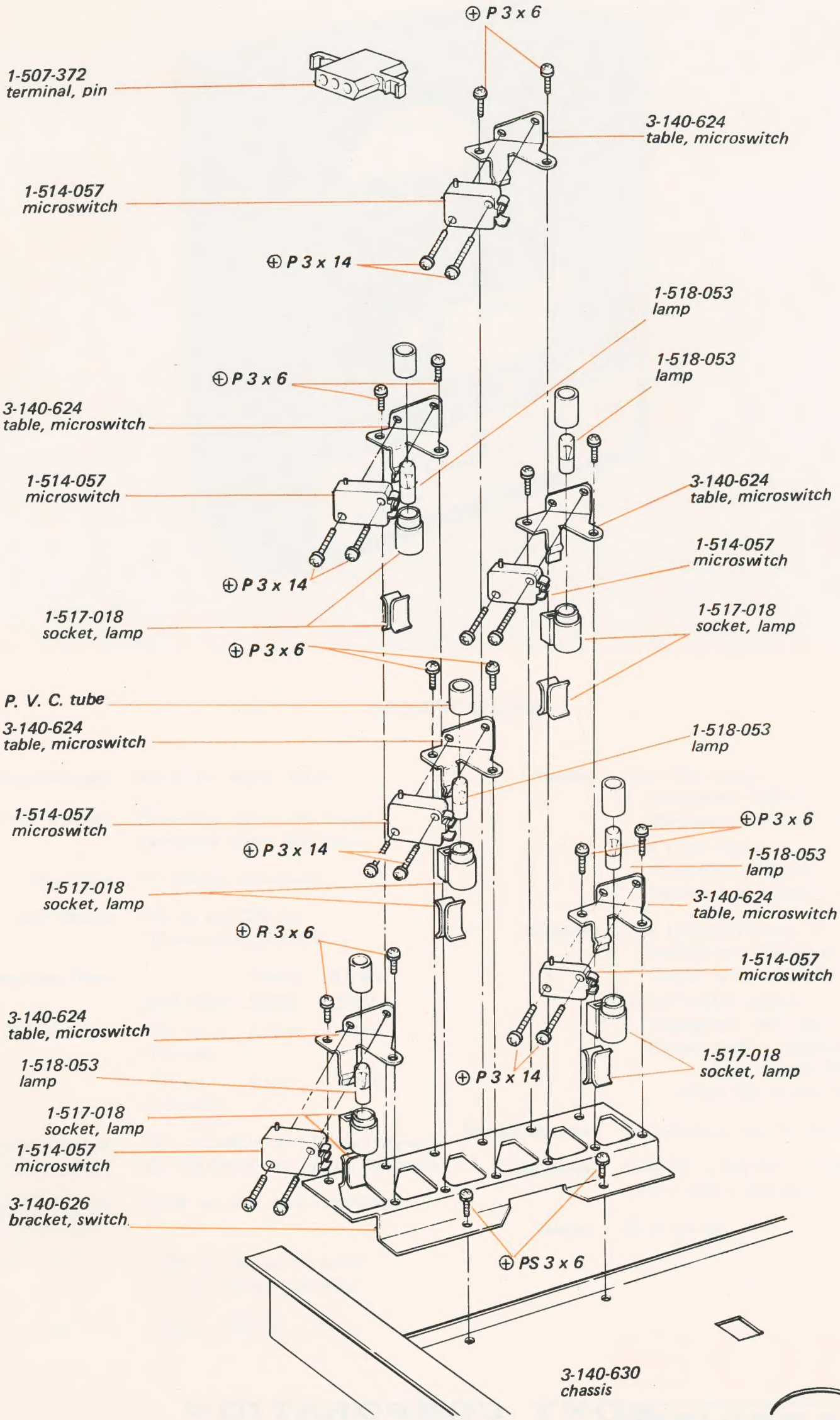



3-140-688
plate, remote plug holding
1-506-180
dummy plug, remote control
1-454-053
solenoid, tape shifter (PM802)
1-117-082
capacitor, MP
(4 µF 250V)
X-31408-51-1
(Up to Serial No. 10,100)
X-31408-51-4
(From Serial No. 10,101 to 11,536)
mounted circuit board,
system control
3-140-930
shield plate, system control
circuit board
1-515-127
relay (RY701~704)
7-626-202-31
cotter pin (1φx10)
3-140-635
supporter, circuit board
attached to
solenoid
3-427-313
pin (A), plunger
1-507-255
socket, remote control
X-31405-06-1
brake ass'y, shifter solenoid
3-140-603
arm, shifter
4-302-090-02
pad, hinge
3-140-695
plate, amplifier holding
3-001-707-07
retainer, wire
3-103-054
screw, thrust adjusting
3-103-055
retainer, thrust
3-103-056
lock nut, adjusting screw
3-140-533
plate, thrust adjusting
1-117-040
capacitor, MP
(2+0.5µF 300V) (C801)
2-832-003
bushing, insulator
lug 3φ, egg type
8-831-634-13
motor, capstan
(HC-634D5) (M801)
transistor
2SD28 (Q703, 707)
2-825-005
spacer, mica
8-836-624-07
motor, reel
(UC-624K)
1-117-082
capacitor, MP
(4 µF 250V)
1-441-579
transformer, power (T801)
3-140-637
leg, mechanical
3-140-636
heat sink
3-140-631
channel, reinforcement
1-205-503
resistor, wire wound
(68 Ω) (R802, 803)
1-205-506
resistor, wire wound
(1 kΩ) (R801)
3-140-632
stay, leg
1-509-341
connector, power (CNJ802); AC OUTLET
1-509-062
connector, power (CNJ801); AC INPUT
3-140-611
plate, connector holding
3-140-695
plate, amplifier holding
3-140-640
nut
3-140-633
bracket (B),
panel holding
3-140-638
bracket (A), panel holding
1-117-054
capacitor, MP
(0.47µF, 350 V)
3-140-527
spacer
3-140-612
bracket
1-536-213
terminal
strip, 5P
3-140-614-03
ornamental plate (A),
connector holding plate
X-20319-01
terminal ass'y
1-532-100
fuse, 2A
1-533-048
holder, fuse
3-140-630
chassis
3-001-707-05
retainer, wire
P 3 x 6
B 3 x 6
W 3 φ
N 3 φ
SW 3 φ
PS 3 x 6
P 4 x 8
P 4 x 6
K 3 x 8
P 3 x 8
P 3 x 12
K 3 x 6
B 3 x 6
P 4 x 10
K 4 x 6
W 4 φ

9-7. CHASSIS – TOP VIEW – (1)



9-8. CHASSIS – TOP VIEW – (2)



SONY CORPORATION

Printed in Japan